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PALEONTOLOGY.—*Jefferson's contribution to paleontology.*[1]

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Thomas Jefferson's life spanned the eventful interval of 83 years from 1743 to 1826. This was a restless time when men rebelled against political tyranny and sought freedom of body and mind to investigate nature, engage in legitimate business, and pursue happiness. Although he is known best for his great contribution to the political and humanitarian part of this movement, the many-sided Jefferson also wrote his name imperishably into the early annals of science in the United States.

If, in 1797, we could have peeped into the baggage that accompanied Jefferson from Monticello to Philadelphia, when he was inaugurated as Vice-President in the administration of John Adams, we should probably have been astonished at what we saw. One box contained some large bones and a manuscript describing them. This manuscript was communicated to the American Philosophical Society at Philadelphia on March 10, 1797, and was published in 1799.[2] The first paragraphs introduce and describe these bones and illustrate Jefferson's style:

> In a letter of July 3d, I informed our late most worthy president that some bones of a very large animal of the clawed kind had been recently discovered within this state, and promised a communication on the subject as soon as we could recover what were still recoverable of them. It is well known that the substratum of the country beyond the Blue Ridge is a limestone, abounding in large caverns, the earthy floors of which are highly impregnated with nitre; and that the inhabitants are in the habit of extracting the nitre from them. In digging the floor of one of these caves, belonging to Frederic Cromer in the county of Greenbriar [now in West Virginia], the laborers at the depth of two or three feet, came to some bones, the size and form of which bespoke an animal unknown to them. The nitrous impregnation of the earth together with a small degree of petrification had probably been the means of their preservation. The importance of the discovery was not known to those who made it, yet it excited conversation in the neighborhood, and led persons of vague curiosity to seek and take away the bones. It was fortunate for science that one of its zealous and well informed friends, Colonel John Stewart of that neighborhood, heard of the discovery, and, sensible from their description, that they were of an animal not known, took measures without delay for saving those which still remained. He was kind enough to inform me of the incident, and to forward me the bones from time to time as they were recovered. To these I was enabled accidentally to add some others by the kindness of a Mr. Hopkins of New York, who had visited the cave. These bones are,
>
> 1 st. A small fragment of the femur or thigh bone; being in fact only its lower extremity, separated from the main bone at its epiphysis, so as to give us only the two condyles, but these are nearly entire.
>
> 2 d. A radius, perfect.
>
> 3 d. An ulna, or fore-arm, perfect, except that it is broken in two.
>
> 4 th. Three claws, and half a dozen other bones of the foot; but whether of a fore or hinder foot, is not evident.
>
> These bones only enable us to class the animal with the unguiculated quadrupeds; and of these the lion being nearest him in size, we will compare him with that animal . . . I will venture to refer to him by the name of the Great-Claw or Megalonyx to which he seems sufficiently entitled by the distinguished size of that member . . .

Then follows a comparison of the respectives bones of the lion and *Megalonyx*. Jefferson concludes:

[1] Substance of an informal communication to the Geological Society of Washington, April 14, 1943. Published by permission of the Director, U. S. Geological Survey. Received May 24, 1943.

[2] JEFFERSON, THOMAS. *A memoir on the discovery of certain bones of a quadruped of the clawed kind in the western parts of Virginia.* Trans. Amer. Philos. Soc. 4: 246–260. 1799.

> Let us only say then, what we may safely say, that he was *more* than three times as large as the lion: that he stood as preeminently at the head of the column of clawed animals as the mammoth stood at that of the elephant, rhinoceros, and hippopotamus: and that he may have been as formidable an antagonist to the mammoth as the lion to the elephant . . .

The remainder of the paper is devoted to speculations as to whether *Megalonyx* had become extinct. As Louisiana Territory had not yet been purchased and explored, Jefferson said: "Our entire ignorance of the immense country to the West and North-West, and its contents, does not authorize us to say what it does not contain." In support of this suggestion that *Megalonyx* might still be living in the western part of the country he submitted reports that carvings on rocks near the confluence of the Kanawha and Ohio Rivers were said to depict lionlike animals; and he recounted tales of settlers and adventurers who said they had heard the roar of strange beasts at night near their cabins and camps.

Unless it is already clearly understood where described fossil specimens have been placed so that future students may examine them, paleontologists should state explicitly how they have disposed of their material. Jefferson did not neglect this office but concluded his paper in somewhat the legal language of a will:

> To return to our Great-Claw: I deposit his bones with the Philosophical Society, as well in evidence of their existence and of their dimensions, as for their safe-keeping; and I shall think it my duty to do the same by such others as I may be fortunate enough to obtain the recovery of hereafter.

These bones are now at the Academy of Natural Sciences of Philadelphia.

Jefferson now had an experience that may come to all paleontologists. It sometimes happens that after a paper has been published the writer discovers that another has anticipated his ideas. Thus, after his paper had been submitted, Jefferson was obliged to add a postscript in which he reports that in the *Monthly Magazine*, September, 1796, London, he had seen an account of animal remains dug up near the LaPlata River in Paraguay. He says:

> This skeleton is also of the clawed kind, and having only four teeth on each side above and below, all grinders, is in this account classed in the family of unguiculated quadrupeds destitute of cutting teeth, and receives the new denomination of Megatherium . . . The Megatherium is not of the cat form, as are the lion, tyger, and panther . . . According to analogy then, it probably was not carnivorous, had not the phosphoric eye, and the leonine roar. But to solve satisfactorily the question of identity, the discovery of foreteeth, or of a jaw showing it had, or had not, such teeth, must be waited for, and hoped with patience. It may be better, in the mean time, to keep up the difference of name.

As this was the only article Jefferson published on fossils he may be classed as a one-paper paleontologist. His interest in paleontology, however, continued unabated, and during his Presidency he had some 300 specimens of mammoth and other bones from the celebrated Pleistocene locality at Big Bone Lick, Boone County, Ky., spread around on the floors of the White House. His generic name *Megalonyx* still stands. He did not propose a specific name for this creature, but this omission was appropriately remedied in 1822 by the French naturalist Desmarest who called it *Megalonyx jeffersoni*. The only assembled skeleton of this species may be seen in the museum of the Ohio State University, Columbus, Ohio. The animal was a ground sloth, of herbivorous habits, and not a lion or lionlike beast as Jefferson thought. *Megatherium* is a genus closely related to *Megalonyx*. Remains of both have been found in Pleistocene deposits, chiefly in caves, at widely scattered localities in North and South America.

Whether Jefferson should be considered an inventor rather than a scientist is a question I shall not attempt to discuss. He was certainly a generous and enthusiastic patron of science and was a potent cause that science was cultivated by other men. He was apparently a member of every literary and scientific society in the country and was in touch with the foremost American scientists of the day—Benjamin Franklin, Joseph Priestly (who had taken up residence in Pennsylvania), Caspar Wistar, etc. He also corresponded with foreign scientists. The first president of the Amer-

ican Philosophical Society was Benjamin Franklin, the second was David Rittenhouse, and the third was Thomas Jefferson.

Jefferson once proposed the establishment of a National Academy of Sciences with headquarters at Washington and branches in every State. This plan, however, did not materialize in his day. It nevertheless casts a revealing light on his mental processes. As everyone knows, he was an individualist who believed in personal initiative and endeavor. He applied this idea in the advocacy of States' rights and against paternalism in the Federal Government. However, he did not find this attitude inconsistent with the use of Federal money for the advancement of science and the diffusion of knowledge which promoted the welfare of the people.

Of all the sciences, stratigraphic geology seemed least interesting to Jefferson. He said that he "could not see any practical importance in knowing whether the earth was six thousand or six million years old, and the different formations were of no consequence so long as they were not composed of coal, iron, or other useful minerals."

PALEONTOLOGY.—*A revision of the genus* Steganocrinus.[1] EDWIN KIRK, U. S. Geological Survey.

Nearly 50 years have passed since the publication of Wachsmuth and Springer's monographic treatment of the North American Crinoidea Camerata. Material collected for some years prior to 1897 and since that time has added considerably to our knowledge of many of the genera and rendered revisions of some of them imperative. Springer had intended to do this work and did so for several genera. Some 30 years ago I pointed out to him that a new genus was represented within the group of species referred to *Steganocrinus*. He agreed that this was so. Doubtless owing to the pressure of more important affairs and ill health, Springer passed *Steganocrinus* by, along with many other projects he had in mind. Several species have erroneously been described under *Steganocrinus*, and one genus has been based on a typical form of the genus. At this time the more obvious synonymies and incorrect citations will be dealt with. The type of *Steganocrinus concinnus* (Shumard) has been found and proves to be much like the original figure of Shumard and quite unlike the forms subsequently referred to it by authors.

Genus **Steganocrinus** Meek and Worthen

Genotype.—Actinocrinus pentagonus Hall, Meek and Worthen, 1866, p. 195.

Synonym.—Shumardocrinus Miller and Gurley. (*Genotype: Actinocrinus concinnus* Shumard, Miller and Gurley, 1895, p. 40.)

Meek and Worthen (1866, p. 195) described the genus *Steganocrinus*, including in it *Actinocrinus pentagonus* Hall, *A. sculptus* Hall, and *A. araneolus* Meek and Worthen. They twice indicate *A. pentagonus* as the typical species, and this genotype has been recognized generally. In a letter to Wachsmuth, dated June 6, 1866, Worthen states: "We have made a genus of *Act. araneolus* which we have named *Steganocrinus*." It has rather generally been assumed that Meek was the responsible author of most of the Meek and Worthen descriptions. In the present instance it appears that Worthen was unaware of Meek's choice of *pentagonus* as type of the genus, although the volume must have been in press at the time the letter was written. Of even more interest for our present purposes, Worthen elsewhere in the same letter writes: "Mr. Meek desires me to ask you if you have a specimen of *Act. sculptus* with any portion of the arms attached; if so he would much like to see it. Perhaps you have only seen it in some other collections, and if so he would like to know whether there is more than one arm to each ray." Further, in a postscript, Worthen writes: "Mr. Meek also wishes to know if you have seen the summit of *Act. sculptus*, and know if it has a proboscis." It is evident that Meek was uncertain at the time whether *A. sculptus* was properly to be placed in *Steganocrinus*.

As restricted, the genus *Steganocrinus* forms a compact, characteristic group of crinoids known at present only in the Burlington limestone and its equivalents of the lower Missis-

[1] Published by permission of the Director, U. S. Geological Survey. Received May 20, 1943.

sippian. Formerly the genus was considered chiefly to be represented in the lower Burlington, but later collections have shown it to be well represented in the upper Burlington. The theca bears a striking resemblance to *Actinocrinus* in form and ornamentation and can be told with certainty only from the structure of the *post-I Ax* brachials. Imperfect specimens, specifically known to be *Actinocrinus*, are often to be found in collections labeled as *Steganocrinus*. All the species described by Miller and Gurley as *Steganocrinus* are referable to *Actinocrinus*. This was inexcusable, as the specimens are in an excellent state of preservation.

The theca of *Steganocrinus* runs a very similar gamut of form to that found in *Actinocrinus*. The earlier species are proportionally low and wide. The later species tend to be more elongate. The tegmen is low and in most species is made up of relatively few fairly large and heavy plates. Typically the dorsal cup is lobate. The lobation in some of the later species is very pronounced. In *Steganocrinus* the *RR* and IBr_1 alone are incorporated in the wall of the cup proper. The distal portion of the IBr_1 is laterally constricted. Ventrad, as seen where *IAx* is detached, there is a deep groove, the distal face of the plate having practically the appearance of a free brachial. The *IAx* flares outward sharply and is essentially a part of the free brachial series. The *IAx* frequently becomes detached, along with the arms. As noted above, it was on the assumed nonexistence of *IAx* that Miller and Gurley based their genus *Shumardocrinus*. In some of the later species of *Steganocrinus* the *R* becomes proportionally larger, the IBr_1 smaller, and the *IAx* greatly reduced.

IAx bears a pair of rami modified into what may be styled arm-trunks. They are uniserial, composed of high *Brr*, and bear relatively short, stout, biserial ramules. The drawing of *S. araneolus* (Fig. 4) is taken from Wachsmuth and Springer (1897). It shows the discrete *IAx* as regards the dorsal cup and the character of the arm-trunks. The ventral groove is covered by series of heavy plates. The structure is well shown in Figs. 1 and 2. These figures are copied from Wachsmuth and Springer (1897), where they are identified as *S. sculptus*. They are actually *S. pentagonus*. The ramules are borne on alternate sides of the ramus. Typically each *Br* bears a ramule. Exceptionally a nonramuliferous *Br* is interposed. The ramules bear pinnules.

Species referred to the genus.—

Steganocrinus araneolus (Meek and Worthen)

Actinocrinus araneolus Meek and Worthen, 1860, p. 387. "Burlington limestone, Burlington, Iowa." (Lower Burlington.)

Steganocrinus araneolus (Meek and Worthen), 1866, p. 198, pl. 15, figs. 1a, b.

Steganocrinus araneolus Wachsmuth and Springer, 1881, p. 151 (325).

Steganocrinus araneolus Wachsmuth and Springer, 1897, p. 581, pl. 61, figs. 2a, b.

It is possible that *S. araneolus* is the young of *S. pentagonus*. It is suggestive that both at Burlington, Iowa, and near Lake Valley, N. Mex., the specimens of *Steganocrinus* fall into two uniform lots. These are mainly separated by size, for the differences in shape and ornamentation could readily be explained as due to growth. There are no specimens in the collections identified as young *S. pentagonus*.

Steganocrinus concinnus (Shumard)

Actinocrinus concinnus Shumard, 1855, p. 189, pl. A, fig. 5. "Encrinital limestone, North River, Marion County, Missouri."

Steganocrinus concinnus Wachsmuth and Springer (pars), 1881, p. 151 (325).

Shumardocrinus concinnus Miller and Gurley, 1895, p. 41. (The specimen shown in pl. 2, figs. 7–10, is probably referable to *S. araneolus* (*pentagonus?*).)

Aside from having been made the type of the "new genus" *Shumardocrinus* by Miller and Gurley, this species has been universally misunderstood. Meek and Worthen (1866, p. 200) placed their *Actinocrinus validus* in synonymy with it. Wachsmuth and Springer (1897, p. 582) followed this precedent and furthermore figured as a representative of the species a form widely divergent both from *S. concinnus* and *S. validus*. The form figured by Wachsmuth and Springer is here made a new species.

Wachsmuth and Springer (1897, p. 583) stated that the type of *S. concinnus* was in the "(Worthen) Illinois State collection at Springfield." They must have been referring to the type of *S. validus*. The type of *S. concinnus* is now in the Springer collection in the United States National Museum, having come to it by purchase from Hambach.

The type of *S. concinnus* is a dorsal cup, lacking the *IAxx*. Miller and Gurley's (1895, p. 41) dogmatic assertion that the species "never had

any third radials" is, of course, utter nonsense. It was on this supposed character that the "genus" *Shumardocrinus* was principally based. The cup is in a good state of preservation. Unfortunately, no complete theca referable to the species is known to me, although one specimen from the upper Burlington near Burlington, Iowa, may be conspecific. Such characters as are shown, however, prove that the species is distinct from any described form. The specimen figured by Miller and Gurley (1895, pl. 2, figs. 7–10) could conceivably be a young individual of this species, but this is doubtful. I have not examined the specimen, but the figures as given suggest *S. araneolus* or possibly a young *S. pentagonus* from the lower Burlington.

The cup of *S. concinnus* as preserved has a maximum breadth of 30 mm and a height of but 16 mm. Were the *IAxx* preserved the height would be increased slightly and the breadth considerably increased. It is this low, broad cup that must serve at present as the chief distinguishing feature of the species. The angle of divergence of the sides of the cup is approximately 74°. The surface of the plates is traversed by sharply defined, radiating ridges, such as are common to many species both of *Actinocrinus* and *Steganocrinus*. The specimen mentioned above from Burlington has approximately the same proportions of cup. In this specimen the tegmen is nearly flat and made up of a large number of small plates, none of which is produced into a spinous process nor, indeed, is highly tumid. The type will be illustrated and described at some future time. At present it is sufficient to show that in *S. concinnus* we are dealing with a species with an exceptionally low, broad cup.

Horizon and locality.—Shumard's original citation is "Encrinital Limestone, on North River, Marion County (Missouri)," collected by Swallow. There seems little doubt, comparing the species with a large series of described and undescribed *Steganocrinus*, that the horizon is upper Burlington.

Holotype.—The holotype is in the Springer collection in the United States National Museum, S. 1181.

Steganocrinus? globosus Wachsmuth and Springer

Steganocrinus globosus Wachsmuth and Springer, 1897, p. 585, pl. 61, fig. 6. "Oolitic bed of the Kinderhook group; Burlington, Iowa."

There is no way of proving that this species is referable to *Steganocrinus*. The general form of the theca and the incorporation of the radial series in the dorsal cup argue against such an assignment. The radial series, so far as the evidence goes, indicates two discrete arms from each ray. Being unable to give the species a definite generic placement, I think it is better to leave it under *Steganocrinus* with a query.

Steganocrinus pentagonus (Hall)

Actinocrinus pentagonus Hall, 1858, p. 577, pl. 10, figs. 6a, b. "Burlington limestone, Burlington, Iowa." (Lower Burlington.)
Steganocrinus pentagonus Meek and Worthen, 1866, p. 196.
Steganocrinus pentagonus Meek and Worthen, 1868, p. 474, pl. 16, fig. 8.
Steganocrinus pentagonus Wachsmuth and Springer, 1881, p. 151 (325).
Steganocrinus pentagonus Keyes, 1894, p. 195, pl. 24, fig. 6.
Steganocrinus pentagonus Wachsmuth and Springer, 1897, p. 579, pl. 61, figs. 3a–e, 4a, b; also pl. 61, figs. 1e, f, given as *S. sculptus*.

Steganocrinus validus (Meek and Worthen)

Actinocrinus validus Meek and Worthen, 1860, p. 384.
Steganocrinus validus Miller and Gurley, 1895, p. 42.

Cited as a synonym of S. concinnus (*Shumard*).—

Actinocrinus concinnus Meek and Worthen, 1866, p. 200, pl. 15, figs. 9a, b.
Steganocrinus concinnus Wachsmuth and Springer, 1897, p. 582.

Over a period of years I have tried to locate the type of this species, but without success. It certainly is not *S. concinnus*, and almost certainly it is a good species. It is to be hoped that the specimen eventually will be found.

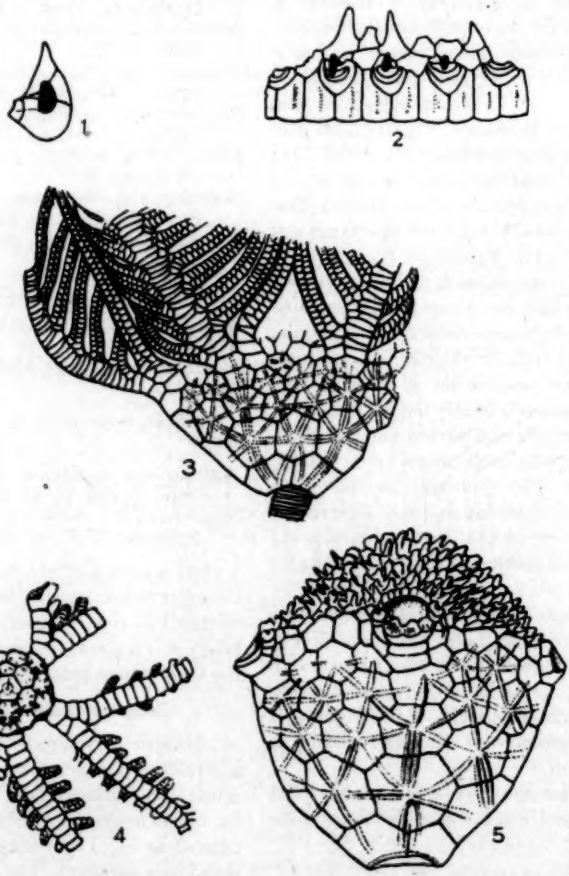
Steganocrinus elongatus, n. sp.

This species is based on the form erroneously ascribed to *S. concinnus* (Shumard) by Wachsmuth and Springer (1897, p. 582, pl. 61, figs. 5a, b). As holotype, I have chosen the specimen figured as 5a. The younger specimen, 5b, will stand as a paratype. The holotype is somewhat crushed and is abnormal as to the radial series of the anterior ray. It is, however, the best specimen known to me, and I have therefore

chosen it as type. The species is rare. In addition to the types there is a specimen larger than the holotype in the Springer collection. Most of the tegmen and a part of the dorsal cup of this specimen are missing. Furthermore, there are a few fragmentary and poorly preserved specimens. It is probable that a few specimens are to be found in other collections.

For *Steganocrinus* the species is a large one, being considerably larger than any described form. There is an undescribed species from the upper Burlington of Hannibal, Mo., that is of comparable size. The theca of the holotype has a height of 41.0 mm and an estimated maximum diameter at the arm-base, uncrushed, of about 30 mm. The paratype, as is to be expected, is relatively less elongate. The height and diameter are approximately equal.

The general habit of the species varies considerably from any described *Steganocrinus*. The cup is relatively high and not strikingly lobate. The tegmen is low and relatively small. The plates of the cup as shown by Wachsmuth and Springer are smooth. The paratype has moderately strong ridges normal to the faces of the plates. The ridges in most cases do not extend to the center of the plates. From the anal and the *r* and *l ant RR* two ridges carry to the



Figs. 1, 2.—*Steganocrinus pentagonus* (Hall): Cross section and lateral view of portion of arm-trunk.
Figs. 3, 5.—*Cyrtocrinus sculptus* (Hall): 3, Specimen showing proximal portions of arm-trunks and atrophied rami; 5, a specimen of about maximum size showing incorporation of the bachials in the cup.
Fig. 4.—*Steganocrinus araneolus* Meek and Worthen: Specimen showing brachial structures.

BB. In all other cases there is one short, broad ridge to each face of the plate. In older specimens, as in the holotype, the ridges are present but are poorly shown. They have practically been obliterated by depositions of stereom.

Relationships.—The relatively elongate theca of *S. elongatus* sharply differentiates it from any described species of the genus. *S. concinnus* (Shumard), as described above, is notable for its unusually low explanate cup.

Horizon and locality.—The species is known only from the upper Burlington. The types are from Burlington, Iowa. One or two rather poorly preserved specimens from Hannibal, Mo., may be referable to the species.

Types.—The types are in the Springer collection in the United States National Museum, S. 1182.

Cyrtocrinus, n. gen.

Synonym.—*Steganocrinus* (in part of authors).
Genotype.—*Actinocrinus sculptus* Hall.

Cyrtocrinus sculptus (Hall), n. comb.

Actinocrinus sculptus Hall, 1858, p. 582, pl. 10, figs. 11a, b. "Burlington limestone, Burlington, Iowa." (Lower Burlington.)
Steganocrinus sculptus Meek and Worthen, 1866, p. 197, text fig. 10 (in part).
Steganocrinus sculptus Wachsmuth and Springer, 1881, p. 151 (325).
Steganocrinus sculptus Keyes, 1894, p. 194, pl. 20, fig. 6 (diagram).
Steganocrinus sculptus Wachsmuth and Springer, 1897, p. 583, pl. 61, figs. 1a–d.

In *Cyrtocrinus* the dorsal cup shows practically no lobation as against the moderate to strongly developed lobation in *Steganocrinus*. This difference in lobation is a direct expression of the very different character of the radial series in the two genera. The tegmen of *Cyrtocrinus* is high and composed of large numbers of small plates. The tegmen is incompetent, in practically all specimens seen being deformed or missing in whole or part.

In very young specimens of *Cyrtocrinus* the brachial series is incorporated in the cup wall up to and including the *IAx*. In such specimens the more distal brachial structures are clearly shown. One division of the ray is hypertrophied forming a heavy arm-trunk, which bears long, stout, biserial ramules. The other half of the division is atrophied, appearing as a biserial structure similar in appearance and size to the ramules borne by the arm-trunk. With increasing age, the proximal portions of the arm-trunk and its homologue progressively become incorporated in the cup wall as shown in Fig. 5, copied from Wachsmuth and Springer (1897). In such specimens the atrophied ramus can easily be mistaken for a ramule borne by the arm-trunk. Such an interpretation has actually been made in the past.

The arm-trunk itself is uniserial, typically bearing ramules on alternate sides on each second brachial. The *Brr* are low. Occasionally there appear to be two *Brr* between ramuliferous *Brr*, but this is uncertain. The ramules are long, stout, and biserial. They bear pinnules. The base of the ramule is set into the side of the arm-trunk in such a way that it is difficult to tell from which *Br* it really originates. Unfortunately no specimens show the ventral surface of the arm-trunk. However, in specimens where a lateral view is to be had between the ramules, it appears that there is no covering of heavy plates comparable to that found in *Steganocrinus*.

Meek and Worthen (1866, p. 197, fig. 10) give a crude diagram of a portion of an arm-trunk identified as *S. sculptus* Hall. The structure as shown in this diagram was repeated by Wachsmuth and Springer (1881, pl. 17, fig. 3). Later (1897, pl. 61, figs. 1e, f) a similar structure was illustrated. These figures are here reproduced as line drawings (Figs. 1 and 2). The original of these latter illustrations is in the Springer collection. As a matter of fact, all these figures were based on *S. pentagonus*. The high, stout *Brr*, the heavy, spinous tegminal plates, and the ramules borne on each brachial clearly indicate this. The fragment illustrated when placed side by side with an arm-trunk attached to a specimen of *S. pentagonus* matches perfectly.

The splendid specimen of *C. sculptus* figured by Wachsmuth and Springer (1897, pl. 61, fig. 1a) for the first time showed the true brachial structures of this species. This specimen is diagrammatically copied, in part, as Fig. 3, from Wachsmuth and Springer (1897). As told to me by Mrs. Wachsmuth, this specimen was a late find and was probably prepared and figured without checking the figures made earlier. The diagram given by Keyes (1894, pl. 20, fig. 6) of *S. sculptus* seems actually to have been based on this specimen. The *Brr* are incorrectly

shown, however, ramules being borne by each brachial.

Relationships.—*Cyrtocrinus* and *Steganocrinus* show a similar modification of the rami into arm-trunks bearing biserial ramules. This is one of the numerous cases of parallel development constantly to be found among the Crinoidea. In the general habit of the theca, which is of great importance among the Camerata, one suspects a quite diverse origin for the two genera. *Cyrtocrinus* and *Cactocrinus* may well have had a common ancestry, while one would assume a similar relationship between *Actinocrinus* and *Steganocrinus*. The most obvious character that distinguishes *Cyrtocrinus* from *Steganocrinus* is the brachial structure. However, in the general habit of the theca *Cyrtocrinus* differs from *Steganocrinus* more widely, for example, than the successive genera in the *Cactocrinus-Teleiocrinus-Strotocrinus* series.

Genus **Actinocrinus** Miller

Miller and Gurley described the following species as *Steganocrinus*: *albersi*, *benedicti*, *blairi*, *griffithi*, *sharonensis*, and *spergenensis*. Bassler and Moodey (1943) have referred all these species, with the exception of *griffithi*, to *Actinocrinus*. In the case of *griffithi*, although listed as *Steganocrinus*, they state: "? = *Actinocrinites scitulus*." All the species are properly referable to *Actinocrinus*, but most of them fall into synonymy as indicated below. *Actinocrinus sharonensis* and *A. spergenensis* may be valid species. There are a number of species of *Actinocrinus* described from these higher horizons, and only by comparing the types of all the species can the proper standing of the various names be established. Miller and Gurley cite *A. spergenensis* as from the St. Louis. Obviously, this is incorrect. However, the "Probably Burlington age" of Bassler and Moodey goes too far on the other side. The crinoid itself indicates an age of at least Borden or Harrodsburg.

The remaining species described by Miller and Gurley almost certainly fall under two of the commonest and best-known species of the upper Burlington, *Actinocrinus scitulus* Meek and Worthen and *A. multiradiatus* Shumard:

Actinocrinus multiradiatus Shumard

Synonymy.—

Steganocrinus albersi Miller and Gurley, 1897, p. 33, pl. 2, figs. 13–16.

Actinocrinus albersi (Miller and Gurley), Bassler and Moodey, 1943, p. 267.

Steganocrinus blairi Miller and Gurley, 1897, p. 35, pl. 2, figs. 21, 22.

Actinocrinus blairi (Miller and Gurley), Bassler and Moodey, 1943, p. 267.

Actinocrinus scitulus Meek and Worthen

Synonymy.—

Steganocrinus griffithi Miller and Gurley, 1897, p. 34, pl. 2, figs. 17–20.

Actinocrinus griffithi (Miller and Gurley), n. comb., this paper.

Steganocrinus sharonensis Miller and Gurley, 1897, p. 32, pl. 2, figs. 10–12.

Actinocrinus sharonensis (Miller and Gurley), Bassler and Moodey, 1943, p. 274.

Actinocrinus eximius, n. name

Actinocrinus griffithi Wachsmuth and Springer, 1897, p. 568, pl. 52, fig. 7, May. (Not *Steganocrinus griffithi* Miller and Gurley, 1897, p. 34, pl. 2, figs. 17–20, Jan. 25.)

It is unfortunate that Wachsmuth and Springer's name must be suppressed as a homonym. Dr. Griffith was one of the group of enthusiastic amateurs to whom we owe so much for our knowledge of the Burlington crinoids. The species is rare, but it is a very distinct form. As holotype I have chosen the specimen figured by Wachsmuth and Springer (1897, pl. 52, fig. 7). There is no need to add to the description of Wachsmuth and Springer. Their comment (1897, p. 579) that the "arm structure approaches the genus *Steganocrinus*" may, however, be deleted.

This case and the invalid species noted above are examples of a large number of similar maleficent acts committed by Miller and Gurley. The manuscript of the Camerate Monograph was completed and transmitted for publication in 1894. The fact was well known to all. Miller and Gurley in their Bulletins of the Illinois State Museum described every specimen they could lay their hands on—good, bad, and indifferent. As was well known to their contemporaries, the main purpose was to forestall the work of Wachsmuth and Springer. Springer in his foreword in the first volume of the Monograph puts the case very mildly. Quite apart from ethical considerations, this wholesale description of species has made for a vast amount of confusion. A great many of the new species described are invalid. The drudgery involved in resolving the problems

presented is enormous and is a thankless task at best.

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BOTANY.—*Ten new American Asteraceae.*[1]

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Nine new species, six of which are from continental Mexico and one each from Texas, Baja California, and Colombia, as well as a new variety of *Corethrogyne californica* from California, are described in this paper. The single species from Colombia, *Tuberostylis axillaris*, is of special interest, belonging to a hitherto monotypic genus which seems to be unique among Asteraceae in its choice of habitat (tree trunks or roots of mangroves and perhaps other trees in saline tidal thickets). The occurrence of the two species now known, which are very distinct in characters of foliage and inflorescence, in the same restricted area at Buenaventura, Colombia, and apparently nowhere else, is of some phytogeographic and evolutionary significance.

Tuberostylis axillaris Blake, sp. nov.

Herba (?) epiphytica ubique glaberrima; folia ovata petiolata acuminata apice obtusa basi acute cuneata integra margine undulata carnosa 3-nervia evenia; capitula in axillis aggregata sessilia.

Herbaceous ?, scandent on tree trunks in tidal thickets; stem (or branch ?) simple, terete, light green, pithy, 2 mm thick; leaves opposite; internodes 2.5–4.5 cm long; petioles 1 cm long, sulcate above, connate at base; blades 4.5–6 cm long, 2.2–2.6 cm wide, dull green, sometimes somewhat pustulate, 3-ribbed from base, the lateral veins mostly invisible; heads about 14-flowered, in axillary clusters of about 3–4, sessile, the common peduncle 1–3 mm long, bearing a few small spatulate herbaceous bracts; involucre strongly graduated, many-seriate, 7–9 mm high, the phyllaries appressed, firmly stramineous, 3-vittate, 2- or 4-ribbed, from triangular-ovate (outer) to linear (inner), all narrowed to an obtusish to acutish apex; corollas apparently whitish, cylindric without distinguishable tube, 4.2 mm long (tube 1 mm, throat 2.5 mm, teeth triangular, obtusish, 0.7 mm long); achenes narrowly oblong, bluntly 3-5-angled or -ribbed, greenish-white, epappose, 2.5–3 mm long, 0.8 mm wide.

COLOMBIA: Vine, scandent up tree trunk in tidal thickets, Buenaventura Bay, Dept. El Valle, 4 May 1939, *E. P. Killip* 35515 (type no. 1772228, U. S. Nat. Herb.).

Tuberostylis rhizophorae Steetz, the only species of the genus hitherto known, is at once distinguished by its spatulate-obovate, very ob-

[1] Received May 24, 1943.

tuse, few-crenate, 1-nerved or weakly triplinerved leaves and terminal panicle. It was described from southern Darien (northwestern Colombia), where it was found by Berthold Seemann on the voyage of the *Herald*, growing on the roots of mangrove (*Rhizophora*), and is still a very rare plant in collections. Specimens are in the U. S. National Herbarium from COLOMBIA: Dept. El Valle: On roots of *Rhizophora* within tide limit, coast of Buenaventura, *Lehmann;* mangrove swamp along Río Dagua, Buenaventura, 7–9 May 1922, *Killip* 5335, 13 April 1939, *Killip* 34958.

The genus is, so far as I know, unique in the family in its choice of habitat (on tree trunks or roots in saline tidal thickets), and the occurrence of its two very distinct species in the same locality is of particular interest. The type sheet bears two stems or branches about a foot long and in old fruit, floriferous in practically all the axils but quite destitute of rootlets.

Brickellia nutanticeps Blake, nom. nov.

Eupatorium nutans H. B. K. Nov. Gen. & Sp. 4: 105. 1820.

Brickellia nutans Robinson, Mem. Gray Herb. 1: 85. 1917. Not *B. nutans* Robins. & Greenm. 1895.

The name *Brickellia nutans* is not available for this species, having been independently proposed by Robinson & Greenman in 1895 for a supposedly new species now considered by Robinson identical with the slightly earlier published *B. orizabaensis* Klatt. The present provision in the International Rules requiring the rejection of later homonyms was not in force when Robinson's *Monograph of Brickellia* was written.

Gutierrezia longipappa Blake, sp. nov.

Suffruticosa ca. 5 dm alta glutinosa hirtella erecte ramosa foliosa; folia linearia integerrima 3-nervia punctata ca. 5 cm longa 2 mm lata in axillis saepe prolifera; capitula minima 2-flora 1-radiata numerosissima subsessilia in apicibus ramorum et ramulorum arcte conferta; involucri cylindrici 4 mm alti gradati phyllaria straminea apice viridia; flores 2,1 femineus ligulatus fertilis, 1 hermaphroditus sterilis ovario abortivo, rarissime ambo hermaphroditi; achenium fl. fem. paene glabrum, pappo e paleis 7-8 liberis achenio longioribus sistente; pappus fl. hermaph. e paleis 10 liberis paene 3 mm longis sistens.

Stem shrubby below, with grayish fissured bark, glabrate, about 6 mm thick; branches erect, whitish below, then straw-color, green above, striate-angled, rather sparsely hirtellous, denudate below; leaves alternate, usually with fascicles or short branches in their axils; internodes mostly 5–7 mm long; blades of larger leaves 4.5–6 cm long, 1.8–2.5 mm wide, acutish, callous-pointed, sessile, flat, sparsely hispidulous, densely impressed-punctate, 3-nerved, the midrib prominent beneath, impressed above, the lateral pair much weaker, impressed beneath, impressed or scarcely evident above; individual flower clusters 1.5–2.5 cm wide, flattish or rounded, the whole forming a flattish panicle about 2 dm wide; heads (moistened) 4.5–5 mm long (excluding style-branches), about 1.8 mm thick, compressed, mostly sessile in clusters of 2–5 at tips of short branchlets, a few sometimes solitary and on pedicels 1 mm long; phyllaries few (7), appressed, the outermost linear, obtuse, 1 mm long, thick-herbaceous, the next ovate or oblong, obtuse, thick-herbaceous in middle above and with scarious margin, the inmost (2) oblong, obtuse, 1-nerved, straw-color, scarious with short blunt green tip; receptacle prolonged into a triangular acute or acuminate point about 0.5 mm long; ray yellow, 4.2–4.7 mm long (tube 2–2.5 mm, lamina oval, emarginate or obscurely 3-denticulate, 3-4-nerved, 2.3 mm long); disk corolla yellow, glabrous, 4.2–4.5 mm long (tube 0.8–1.1 mm, throat subcylindric to funnelform, 2.3–2.5 mm, teeth 5, narrowly triangular, recurved, somewhat thickened at tip, 0.7–0.8 mm long); achene oblong or oblong-obovoid, very sparsely erect-pilose, 5-nerved, 1.2 mm long, the pappus of 7–8 free linear oblong 1-seriate obtuse to acute somewhat unequal paleae 1–1.8 mm long; pappus of hermaphrodite flower sub-2-seriate, of 10 subequal linear-oblong acuminate paleae 2.8–3 mm long; style branches of hermaphrodite flower linear, acuminate, hispidulous on back throughout, without stigmatic lines.

TEXAS: 12 miles east of Marfa, Presidio County, 19 Oct. 1937, *V. L. Cory* 26335 (type no. 151924, herb. U. S. Nat. Arboretum); Sanderson, Terrell County, 29 Sept. 1911, *E. O. Wooton* (U. S. Nat. Herb.).

The type specimen was sent by Mr. Cory under the name *Selloa glutinosa* Spreng. (*Gym-*

nosperma glutinosum Less.), to which it bears a remarkably close resemblance, although the leaves of that plant are somewhat broader and 3-ribbed; but in *Selloa glutinosa* the heads are about 9-14-flowered, the rays are much smaller, the disk flowers are fertile, the achenes are densely puberulent, and the pappus is wanting. *Gutierrezia longipappa* is distinguished from most species of its genus by its 2-flowered heads, and from all known to me by its subglabrous achenes and very long pappus. Wooton's specimen, mounted with one of *Selloa glutinosa*, agrees closely with the type in essential characters but has a slightly longer ray (lamina elliptic, 3 mm long) and a somewhat shorter pappus (2 mm) in the hermaphrodite flower; the plant is more conspicuously glutinous and the leaves are narrower (1.5 mm) with the lateral pair of veins only obscurely indicated.

Corethrogyne californica DC. **var. lyonii** Blake, var. nov.

Involucri 5-6-seriati subaequalis vel paullum gradati 1.2–1.8 cm alti phyllaria lineari-oblonga v. paullum oblanceolata maxima ex parte (exteriora omnino) herbacea laxa v. squarrosa.

Stems 12–20 cm long, decumbent or ascending, numerous, densely white-tomentose like the leaves; leaves obovate, 3–4.5 cm long including petiole, 0.8–1.5 cm wide, subentire to crenate-serrate above; peduncles terminal, solitary, 1-headed, green and merely stipitate-glandular, 2–5.5 cm long, bearing 2 or 3 glabrescent bracts; phyllaries 2–2.5 mm wide, often slightly broadened upwardly, densely stipitate-glandular and thinly pubescent, the outer herbaceous throughout, the middle ones with subscarious margin below, the inmost with chartaceous base and short green tip.

CALIFORNIA: Open slope, Cathedral Peak, southwest corner of sec. 22, T. 11 S., R. 7 E., Merced County, altitude 915 meters (3,000 feet), 4 June 1941, *Gregory S. Lyon* 1572 (type no. 154588, U. S. Nat. Arb.; dupl. herb. Univ. Calif.); Twin Peak, NW¼ sec. 36, T. 11 S., R. 7 E., Merced County, altitude 610 meters (2,000 feet), 12 May 1939, *Lyon* 1310 (herb. U. S. Nat. Arboretum, herb. Univ. California).

Although strikingly different from the common coastal form in its large and loose herbaceous involucre, this plant cannot be considered more than a variety. The two collections cited come from the Inner South Coast Ranges. Another more ample collection from the same region (*Lyon* 1428), open rocky slope, Laveaga Peak, SW¼ sec. 14, T. 12 S., R. 7 E., San Benito County, alt. 915 meters, 2 June 1940) has a shorter, strongly graduated involucre with the 3–4 outer series of phyllaries herbaceous only above, and must be considered an intermediate nearer to the typical form. The variety is named for the collector, a former student of Prof. H. L. Mason and Prof. Lincoln Constance, who has made extensive collections in the little-known Inner South Coast Ranges of San Benito, Merced, and Fresno Counties, California.

Archibaccharis peninsularis Blake, sp. nov.

Frutex laxus parum ramosus foliosus; caulis tenuis striatus purpureo-brunneus subglabratus, rami viridescentes dense hispiduli; folia ovalia v. obovata obtusa v. acutiuscula apiculata basi cuneata in petiolum folio multiplo breviorem anguste decurrentia utroque latere grosse 1-3-dentata pergamentacea supra laete viridia subtus paullo pallidiora utrinque sparse pilis conicis basi subtuberculatis hispidula margine hispidulo-ciliolata; capitula staminea parva 24-flora numerosa apice ramorum paniculata tenuiter pedicellata folia paullum superantia; involucri hemispherici 3 mm alti ca. 4-seriati gradati phyllaria oblonga v. oblongo-ovata obtusa 1-vittata scarioso-marginata supra ciliata; corollae purpureae, dentibus fauce brevissima multiplo longioribus; achenia compressa 2-nervia erecto-hirsuta; pappus 1-seriatus, setis hispidulis ad apicem incrassatic et barbellatis.

"Low reclining bush with stems 1–1.5 m long"; stem 2.5 mm thick, striate and subangulate by decurrent lines from the leaf-bases; branches few, simple except for a subterminal branch, about 30 cm long or less, greenish, densely cinereous-hispidulous with short several-celled subconic spreading white hairs; leaves alternate; internodes mostly 4–15 mm long; petiole 3–9 mm long, narrowly margined nearly or quite to base, densely hispidulous; blade 2.5–4 cm long, 1.3–2.5 cm wide, plane, coarsely few-toothed mostly above the middle (teeth 1–2 mm high, acute or obtuse, callous-apiculate), feather-veined (lateral veins 3–4 pairs, prominulous on both sides, the secondaries inconspicuous), roughish especially beneath, the hairs denser along costa beneath; panicle

about 17–40-headed, 4–6 cm wide, flattish or somewhat convex, surpassing the leaves by 1–2 cm, pubescent like the stem, the bracts small, lanceolate, the pedicels 2–6 mm long; heads (moistened) 5 mm high, 3.5 mm thick; phyllaries glabrous dorsally, the vitta greenish above; receptacle naked; corollas glabrous except for a few clavellate hairs at base of throat, 3.5 mm long (tube whitish, 1.7 mm, throat campanulate, 0.3 mm, teeth purple, recurving, lanceolate, 1.5 mm long); achenes oblong-obovate, 1 mm long, whitish, erect-hirsute with bidenticulate hairs; pappus bristles about 30, slender, white 2.8 mm long; style branches 1 mm long, hispidulous on back above, with obtuse appendages and no evident stigmatic lines.

BAJA CALIFORNIA: In shade in small canyon, on rocky talus slopes under oaks, Arroyo Hondo, Sierra Giganta (between La Paz and Loreto), 13 Dec. 1938, *H. S. Gentry* 4120 (type no. 263147, Dudley Herb.; photograph and fragments, herb. U. S. Nat. Arboretum).

This interesting plant, sent me for study by Mrs. Roxanna S. Ferris, is referred to *Archibaccharis* with some doubt, since only the staminate plant is known. In general habit and in the comparatively thin leaves it agrees better with that genus than with *Baccharis*, the only other genus to which it could be referred, and in any case it is quite distinct from any known species of either group. The genus *Archibaccharis* has not previously been reported from Baja California. The species appears to be nearest *Archibaccharis serratifolia* (H.B.K.) Blake, of Mexico proper, a plant with ovate or lance-ovate, sharply acute or acuminate, regularly serrate or serrulate, much more densely pubescent leaves.

Gnaphalium panniforme Blake, nom. nov.

Gnaphalium pannosum Gray, Proc. Amer. Acad. 19: 3. 1883. Not *G. pannosum* (DC.) Sch. Bip. Bot. Zeit. 3: 172. 1845.

This Mexican species is apparently still known only from the original collections by Schaffner (no. 227) and Parry & Palmer (no. 420) in the mountains of San Luis Potosí.

Heliopsis parviceps Blake, sp. nov.

Annua tenuissima superne pauciramosa remote foliata, caule bifariam puberulo; folia minuscula ovata acuminata basi late cuneata v. subcordata tenuia serrata triplinervia utrinque hirsutula; capitula pro genere minima tenuissime pedunculata omnino purpurea, radiis interdum supra brunneoflavescentibus exceptis; involucri 2-seriati subaequalis ca. 3.5 mm longi phyllaria oblonga v. late ovata; radii 4–5 minimi; achenia radii obovoidea corticata parum tuberculata epapposa, disci oblonga epapposa.

Very slender annual, about 4 dm high, with about 2 elongate branches above, these themselves often with 2 or 3 branches at apex; stem greenish white, about 1.5 mm thick, striatulate; leaves below middle of stem only 2–3 pairs, small (blades 2 cm long, 1.2 cm wide), mostly fallen at flowering time, separated by long internodes; leaves near middle of stem 2–3 pairs, with short internodes (mostly 7–28 mm long), their petioles very slender, 8–15 mm long, flattened above, pilosulous chiefly on margin, their blades ovate, 3–4 cm long, 1.2–1.7 cm wide, green and evenly but not densely antrorse-hirsutulous on both sides with subtuberculate-based hairs; branches when well developed with a long naked internode up to 18 cm long, then bearing 1–2 pairs of rather crowded narrower leaves and 2–3 long-peduncled heads, the peduncles often with a pair of leaves and an undeveloped head above the middle; heads about 11 mm wide (moistened), about 3–10 per stem, solitary and terminal on long and very slender bifariously puberulous peduncles 2.5–8.5 cm long; disk at maturity conical, 6–8 mm high, 5 mm thick; involucre 2-seriate, subequal, 3–3.8 mm high, the phyllaries few (ca. 12), appressed, the outer oblong, obtuse, about 1.5 mm wide, the inner broader, broadly ovate, obtuse, all sparsely puberulous, ciliolate, at first subindurate and pale below, with 3 green vittae and shorter subherbaceous tip, at maturity strongly suffused with purple throughout; rays 4–5, pistillate, fertile, spreading, deep purple on both sides or sometimes dull brownish yellow above, finely papillate on both faces, jointed to the achene and detachable from it, their margins somewhat inflexed for about 0.5 mm above base but the proper tube a mere ring only 0.2 mm long, the lamina suborbicular, thickish, 3.2–3.5 mm long and wide, bluntly 3-toothed, 10–12-nerved (2 of the nerves stronger), hispidulous on the ringlike base and on the nerves dorsally; disk corollas deep purple, glabrous, 3 mm long (tube 0.4 mm, throat 2 mm, not wider than tube for 0.6 mm, then slender-

campanulate, teeth ovate, acute, 0.6 mm long); pales rather thin, 3.6–4.2 mm long, purple above, glabrous, keeled for two-thirds their length or more from base, broadly rounded or subtruncate and bluntly mucronulate; ray achenes broadly obovoid, corticate with a thick papillate and somewhat tuberculate, fleshy, detergible outer layer, sublenticular, about 3.6 mm long, 2.5 mm wide, rounded on outer face, with a single broad rib on inner face, greenish fuscous, sparsely and obscurely puberulous, with narrow thick margin, this irregularly denticulate or tuberculate and with 2 larger teeth toward apex; disk achenes (immature) oblong, 1 mm long, glabrous, somewhat thickened, truncate, epappose; style branches hispidulous toward apex, with subdeltoid short-cuspidate hispidulous appendages.

MEXICO: Along Cuernavaca-Taxco Road, about 10 miles from Taxco, Guerrero, alt. 1675 meters, 19 Aug. 1935, *L. H. MacDaniels* 128 (type no. 837092, herb. Field Mus.; photograph and fragments, herb. U. S. Nat. Arboretum).

This plant is described as a *Heliopsis* with some hesitation. The ray corollas, set in a concavity at apex of achene, definitely jointed to it, and rather readily detachable, are out of place in the genus and at odds with the definition of the subtribe to which *Heliopsis* belongs. Its closest relationship, nevertheless, seems to be with that genus, and it is referred there for the present. The species is readily distinguished by its tiny purple heads.

Zexmenia appressipila Blake, sp. nov.

Frutex ramosus; caulis tenuis dense strigillosus; folia lanceolata attenuata falcata basi acute cuneata breviter petiolata triplinervia inconspicue serrulata firme herbacea utrinque viridia et scabriuscula supra ubique sed non dense strigosa pilis basi lepidotis non tuberculatis et strigillosa subtus ubique non dense strigosa et sessili-glandulosa glandulis albidis; capitula solitaria terminalia pedunculata radiata aurea ca. 5 cm lata; involucri 1.2–1.3 cm alti campanulati ca. 4-seriati phyllaria exteriora strigosa basi ovata indurata pallida appendice longiore herbacea laxa lanceolata, interiora multo breviora ovalia pallida abrupte breviterque herbaceo-appendiculata, intima exappendiculata; achenia neque alata neque marginata, ea disci pappo 1-aristato et squamellato donata.

Slender shrub, opposite-branched, the stem grayish brown, about 3 mm thick, subterete; internodes mostly 3–5.5 cm long; petioles 4–6 mm long, obscurely margined, strigillose and on margin strigose, not ciliate; blades 9–11 cm long, 2.3–2.6 cm wide, usually strongly falcate, obscurely serrulate (teeth about 6–8 pairs, about 0.3 mm high, 4–8 mm apart, blunt, callous), prominulous-reticulate beneath and with a pair of strong lateral veins arising about 1 cm above base of leaf, slightly shining on both sides, deep green above, slightly lighter green beneath; peduncles slender, densely strigillose, 3–4 cm long, shorter than the upper leaves; disk 1.5-(fruit) 1.2 cm high, 1 cm thick; outer phyllaries 12–13 mm long, with pale indurated ovate base 3–4 mm wide, densely strigillose with lepidote-based hairs, and longer, lanceolate, acuminate, loosely spreading, sparsely strigillose tip 2.5–3 mm wide, the next series equal in length, similar but broader with subscarious-margined oval-oblong base and relatively shorter, more abrupt herbaceous tip, the next series much shorter, mostly subscarious with short narrow abrupt herbaceous tip, strigose toward tip, the inmost entirely subscarious, obtuse, obscurely ciliolate; rays 9 or more, golden yellow, elliptic-oblong, the tube about 2 mm, the lamina about 2–2.5 cm long, 6 mm wide; disk corollas golden yellow, essentially glabrous, 6.5 mm long (tube 1.5 mm, throat 4 mm, teeth 1 mm); pales narrow, 1-toothed on each side, acuminate, purplish-tipped, minutely hispidulous-ciliolate; ray achenes narrowly obovate, 5 mm long, 1.3 mm wide, 3-angled, not winged or margined, finely hispidulous, their pappus of 3 fragile awns (the 2 outer 1.5–1.8 mm, the inner 4 mm long) and about 5 squamellae about 0.5 mm long, these somewhat united with the awns at base; disk achenes nearly linear, blackish, 5–5.5 mm long, 1 mm wide, compressed, 1-ribbed on each face, 4-angled, not winged or margined, sparsely hispidulous, their pappus of a single slender awn 5 mm long and about 5–6 obtuse hispid-ciliate squamellae up to 1 mm long and united at base.

MEXICO: In pineland, Mount Ovando, Chiapas, 14–18 Nov. 1939, *E. Matuda* 3954 (type no. 151925, herb. U. S. Nat. Arboretum).

Distinguished by its comparatively narrow,

long-acuminate, short-petioled leaves, lepidote-strigose and strigillose above and strigose beneath (the hairs not spreading even when the leaves are moistened), its solitary, rather short-peduncled heads with abruptly herbaceous, spreading phyllary tips, and its wingless and, marginless achenes. The species is apparently nearest *Zexmenia aurantiaca* Klatt, which has ovate leaves with non-appressed pubescence. The descriptions of *Z. monocephala* (DC.) Heynh. and *Z. strigosa* (DC.) Sch. Bip. somewhat suggest this plant, but the types of both species, which I examined and photographed in 1925, are entirely different from it.

Verbesina phyllolepis Blake, sp. nov.

Frutex ?; caulis strigillosus anguste alatus; folia lanceolata utroque acuminata sessilia vix auriculata decurrentia supra partem inferiorem integram serrulata supra saturate viridia tactu laevia sparse strigillosa subtus pallidius viridia densius strigillosa penninervia; capitula in apicibus ramorum 1–3 ca. 4 cm lata aurea radiata breviter pendulata; involucri ca. 4-seriati gradati ca. 4 mm alti phyllaria oblonga subindurata pallida, appendice longiore herbacea lineari-elliptica v. subspathulata obtusa apice callosa late patente donata; radii ca. 20 lamina elliptico-oblonga ca. 17 mm longa 4.5 mm lata.

Shrubby ?, sparsely branched above; stems subterete, brownish, striate, rather densely strigillose, winged throughout (only upper part seen) by the decurrent leaf bases, 3 mm thick, the wings in pairs from each petiole-base, herbaceous becoming dry, entire, somewhat veiny, 1–2 mm wide; internodes mostly 7–15 mm long; leaf blades 8–10.5 cm long, 1.5–2.5 cm wide, herbaceous, serrulate above the entire lower third (teeth 4–10 on each side, obtusely callous-tipped, about 1 mm high, 4–12 mm apart), the costa whitish, prominent beneath, rounded, the chief lateral veins 5–7 pairs, curved, prominulous beneath; heads solitary at tip and in the uppermost axils, the peduncles 0.5–2 cm long, winged like the stem; involucre (excluding the appendages) about 4 mm high, puberulous, the herbaceous appendages about 5–7 mm long, 1–1.5 mm wide, spreading or deflexed; rays pistillate; disk corollas numerous, golden, glabrous except for the sparsely pubescent tube, 4.3 mm long (tube 1.1 mm, throat 2.5 mm, teeth ovate, 0.7 mm long); pales yellowish green, pubescent on the narrow keel, acute, 5 mm long, with erect or in youth somewhat inflexed tip; achenes (very immature) obovate, hispidulous above and on the very narrow wings, 2.3 mm long; awns 2, hispidulous, 1.5–1.8 mm long.

MEXICO: In pineland, Mount Ovando, Chiapas, 14–18 Nov. 1939, *E. Matuda* 3953 (type, Herb. Univ. Michigan; photograph and fragments, herb. U. S. Nat. Arboretum).

A member of the section *Verbesinaria*, related to *V. neriifolia* Hemsl. and less closely to *V. liebmannii* Sch. Bip., but distinguished by the conspicuous spreading or reflexed herbaceous appendages of the phyllaries. The leaves are alternate.

Tridax accedens Blake, sp. nov.

Herba ramosa 45 dm alta, basi invisa; caulis patenti-glandulari-pilosus; folia opposita ovata bene petiolata acuta basi subtruncata pauciserrata sparse hirsuto-pilosa; capitula numerosa mediocria discoidea cymoso-paniculata, pedicellis capitulo saepius multiplo longioribus; involucri 1-seriati ca. 3.5 mm alti phyllaria ovali-oblonga apice rotundata subglabra viridescentia margine scariosa; corollae albae; achenia 5-costata dense pilosula; pappus ca. 20-squamellatus, squamellis flor. exteriorum lacerato-fimbriatis ca. 0.4 mm longis, eis flor. interiorum fimbriatis ca. 1 mm longis.

Stem "5 dm high," about 3.5 mm thick, with numerous erectish branches above, green, purplish-tinged, subterete, somewhat sulcate below, rather sparsely spreading-pilose with several-celled hairs 1–1.5 mm long mostly tipped with brownish glands, the branches and pedicels also puberulent with minute several-celled mostly incurved glandless hairs; leaves opposite, much shorter than the internodes; petioles of larger leaves 2.8 cm long, narrowly margined above, pilose with gland-tipped hairs; blades of larger leaves 5 cm long, 4 cm wide, subtruncate at base and then shortly cuneate-decurrent into the petiole, remotely repand-serrate with 5–6 pairs of low bluntish teeth, herbaceous, green on both sides, above sparsely hirsute-pilose with subtuberculate-based hairs, beneath more sparsely hirsute-pilose chiefly along the veins, triplinerved about 4 mm above the base; panicle about 30 cm long, 19 cm wide, nearly naked, its lowest branches subtended by reduced leaves, the remaining bracts

linear-lanceolate or narrowly triangular, 3–10 mm long; pedicels mostly 1–3.5 cm long; heads campanulate, about 22-flowered, about 5 mm high, 7 mm thick (as pressed); phyllaries 5, 1-seriate, all subtending flowers, sometimes with a single small additional sterile outer one, greenish but not at all herbaceous, with narrow whitish scarious margin, usually brownish at apex, 6-8-vittate, obscurely ciliolate above, glabrous on back; receptacle low-conical, the pales readily deciduous; corollas white, densely hirsutulous on tube, sparsely so on some of the nerves and on teeth, 3.5–3.8 mm long (tube 1 mm, throat cylindric-oblong, about 1.5 mm in outer corollas, 1.8 mm in central flowers, teeth 5, broadly triangular, 1.2 mm long in outer corollas, 0.8 mm in central corollas); pales oblong, rounded, membranous, with greenish center and about equally broad hyaline margin, 3-5-vittate, ciliolate at apex, otherwise glabrous, not strongly conduplicate, 2.8 mm long; achenes of outer flowers obovoid, somewhat compressed, densely and shortly silky-pilose (the hairs spreading when wet), 5-ribbed (1-ribbed on inner face, 2-ribbed on outer, the ribs on outer face blackish, glabrous, and conspicuous), 2 mm long, their pappus persistent, of about 20 lanceolate lacerate-fimbriate squamellae, united at base, about 0.4 mm long; central achenes obpyramidal, with 5 black glabrous ribs, densely short-pilose (the hairs spreading when wet), 1.8 mm long, their pappus of about 20 alternately somewhat unequal oblong obtuse fimbriate squamellae 0.8–1 mm long, united at base in a thick ring; intermediate fruits with intermediate characters.

MEXICO: In llano, Coalcoman, Dist. of Coalcoman, Michoacán, alt. 1,000 meters, 9 Jan. 1939, *G. B. Hinton* 12884 (type no. 1748961, U. S. Nat. Herb.); same locality, 31 Dec. 1938, *Hinton* 12850 (U. S. Nat. Herb.).

Tridax dubia Rose, the only close relative of this species, is readily distinguished by its densely pubescent involucre, essentially glabrous or merely puberulent achenes, and short yellow rays.

Perezia scaposa Blake, sp. nov.

Herba perennis scaposa 60 cm alta, caudice crasso longe brunnescenti-piloso; folia rosulata magna oblonga v. oblongo-obovata lyrato-pinnatifida membranacea infra in costa sparse et decidue pilosa segmento terminali magno ovato acuto repando-dentato segmentis lateralibus 3–4-jugis multo minoribus deorsum decrescentibus oblongis acutis repando-dentatis, petiolo brevi anguste alato; scapi 3 tenues parce pilosi remote bracteati bracteis herbaceis subulatis erectis paucidentatis 8–10 mm longis paniculam laxam oblongam multicapitatam subaequantes, pedicellis capillaribus minute bracteatis 1–2 cm longis; capitula parva 5–7-flora, in fructu (corollis delapsis) 8–10 mm longa; involucri 6 mm alti valde gradati ca. 5-seriati phyllaria exteriora parva ovata v. oblongo-ovata 1–2.5 mm longa acuta viridescentia ciliolata dorso glabra, media lanceolato-oblonga, intima linearia acuta v. obtusa apiculata; achaenia minute hispidula 4.5 mm longa; pappus stramineus 5 mm longus.

Rootstock about 4 cm long, 1 cm thick, horizontal, bearing fibrous roots; scapes 1–1.5 mm thick at base; leaves all basal, about 7, 15–27 cm long (including the short narrowly winged petiole, this 1.5–5 cm long), 6–12.5 cm wide, dark green, lightly prominulous-reticulate on both sides, essentially glabrous above, beneath with some loose deciduous pilosity along the midrib and veins and sparse appressed hairs on the surface; panicles about 30 cm long, 9–12 cm wide, thinly pilosulous, the branches diverging at an angle of about 30–45°, the bracts of the pedicels lanceolate or subulate, appressed, about 1 mm long; outer phyllaries passing into the bracts at apex of pedicels, 1 mm wide or less, acute and shortly apiculate, the middle ones about 1.5 mm wide, the inmost acute or obtuse, short-apiculate, 1 mm wide, all slightly ciliolate toward apex, glabrous on back; receptacle fimbrillate; corolla 2-lipped, 7 mm long, glabrous, the outer lip oval, 3 mm long, 3-dentate, the inner 2-parted; achene fusiform, olive-green, 4–4.8 mm long, very shortly hispidulous with partly subglandular-tipped hairs; pappus soft.

MEXICO: On cliff, Aquila, Dist. Coalcoman, Michoacán, alt. 250 meters, 24 March 1941, *G. B. Hinton* 15838 (type no. 1820864, U. S. Nat. Herb.).

This species is clearly distinct from any of the 5 scapose species described from Mexico and Central America in Bacigalupi's revision[2] of the North American species of the genus. Its closest ally is apparently *P. nudiuscula* Robin-

[2] Contr. Gray Herb., no. 97. 1931.

son, still known only from the original collection from Nayarit (Tepic), which lacks the basal leaves. In *Perezia nudiuscula* the bracts of the scape are much larger (2–4 cm long), the heads 12–20-flowered and decidedly larger (involucre 8–11 mm high), and the pappus bright white.

Perezia simulata Blake, sp. nov.

Herba 1 m alta; caulis tenuis puberulus glabratus subflexuosus; folia oblongo-ovata majuscula chartacea acuminata sessilia amplexicaulia repando-denticulata dentibus spinulosis utrinque reticulato-venulosa supra in venis puberula subtus in venis et venulis puberula; capitula mediocria 5-flora in axillis foliorum capitato-congesta; pedicelli breves dense squamosi squamis triangulari-subulatis subpungentibus in phyllaria involucri transeuntibus; involucri anguste obconici valde gradati ca. 11 mm alti phyllaria lineari-lanceolata longe acuminata subpungentia erecta straminea glabra; corollae bilabiatae; achenia subrostrata dense glandulosa et minute hispidula.

Stem very slender, subterete, multistriate, whitish tinged with purple-brown, puberulous with crisped spreading essentially eglandular hairs, becoming for the most part completely glabrate, with some branches above, these shorter than the leaves; leaves 13–15 cm long, about 6.5 cm wide, plane, spinulose-denticulate throughout, feather-veined (lateral veins about 6–8 pairs), strongly amplexicaul with rounded auricles or the smaller upper ones merely sessile, above puberulous with eglandular hairs on the costa and chief veins, otherwise nearly glabrous, beneath densely puberulous or pilosulous with spreading several-celled eglandular hairs on all the veins and veinlets and sparsely on surface, subsessile-glandular on surface; heads in capitate clusters of about 8–11 in axils of stem and branch leaves, the clusters about 2 cm high, 3–4 cm wide (as pressed), the short pedicels (about 5 mm long) completely concealed by the numerous triangular-subulate long-acuminate subpungent stramineous bracts, these minutely ciliolate, otherwise glabrous, about 3–5 mm long, passing into the phyllaries; proper involucre slenderly obconic, about 11 mm high, 3 mm thick (moistened), its phyllaries rather few (about 7), linear-lanceolate, long-acuminate into subpungent straight tips, greenish, narrowly pale-margined, stramineous, minutely ciliolate, otherwise glabrous, 1.2–1.5 mm wide; corollas "purple," minutely puberulous outside with subcapitate hairs, 11 mm long, the outer lip 4.8 mm long, 3-dentate, 4-nerved, the inner lip divided to base into 2 linear acute lobes 4.8 mm long; achenes slender, subrostrate, densely glandular and minutely hispidulous, 6 mm long; pappus white, 9 mm long.

MEXICO: In woods, Coalcoman, Dist. of Coalcoman, Michoacán, alt. 1000 meters, 15 March 1939, *G. B. Hinton* 13654 (type no. 1748962, U. S. Nat. Herb.).

Closely similar in habit and most characters to *Perezia dugesii* Gray but with much narrower and more gradually acuminate phyllaries. In none of the specimens of *P. dugesii* examined are the squamose bracts of the pedicels so numerous or so narrow.

Stephanomeria cinerea Blake, comb. nov.

Ptiloria cinerea Blake, Proc. Biol. Soc. Washington 35: 177. 1922.

ORNITHOLOGY.—*A new wood quail of the genus* Dendrortyx.[1] HERBERT FRIEDMANN, U. S. National Museum.

Recent study of a large series of wood quail has revealed that the form hitherto known as *Dendrortyx macroura griseipectus* Nelson is in reality a composite of two separable subspecific entities. Hellmayr and Conover (Cat. Birds Amer., pt. 1, no. 1: 225–226. 1942) give the range of *griseipectus* as comprising only "two widely separated localities, Huitzilac, Morelos, and San Sebastián (northwest of Mascota), Jalisco, Mexico," and further state that "although San Sebastián, Jalisco, is widely separated from Huitzilac, Morelos, and the range of *D. m. striatus* in Michoacan would seem to intervene somewhat, the Jalisco specimens are so nearly like *griseipectus* from Morelos and so different from *striatus* that no other

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way is left than to place them in the same race." I find, on the contrary, that the birds of the two localities are as separable from each other as are the other recognized (and valid) races of the species. The Huitzilac, Morelos, birds, being topotypical *griseipectus*, retain that name, while for the San Sebastián, Jalisco, specimens I propose the name—

Dendrortyx macroura diversus, n. subsp.

Type.—U. S. N. M. (Biol. Surv. Coll.) 155936, ♂, San Sebastián, Jalisco, Mexico, collected March 28, 1897, by E. W. Nelson and E. A. Goldman.

Subspecific characters.—Similar to *D. m. griseipectus* Nelson but differing in having the lower back, rump, and upper tail coverts more olive-brown and with no or little black barring; in having the flanks and thighs more olive-brown, less barred; and in having the under tail coverts more brownish, less blackish, with less contrast between the dark areas and the whitish tips.

Range.—Known only from northwestern Jalisco (Mascota and San Sebastián).

Measurements.—4 ♂, including the type—wing 153–161 (156); tail 138–149 (144.5); culmen from the base 20.6–20.8 (20.65); tarsus 50–53 (51.1); middle toe without claw 39.7–40.1 (40.2 mm), 3 ♀—wing 141–151 (146); tail 119–141 (128.7); culmen from base 19.5–20.8 (20.3); tarsus 47–47.5 (47.2); middle toe without claw 38–38.9 (38.3 mm).

ICHTHYOLOGY.—*Two new characinid fishes from South America of the genus* Gilbertolus *Eigenmann.*[1]

LEONARD P. SCHULTZ, U. S. National Museum.

In recent studies of some characinid fishes that I collected in the Maracaibo Basin of Venezuela, it was observed that the forms of *Gilbertolus* inhabiting the Río Atrato and the Río Magdalena of Colombia and the Maracaibo Basin differed from each other so much that it was decided to describe two of them as new subspecies. The form from the Magdalena River was described by Steindachner in 1878.

The members of this genus seem to occur most frequently in the quiet waters of swampy areas and less frequently in the quieter pools of the rivers. They are nowhere abundant, however, and few specimens are preserved in museums.

Genus **Gilbertolus** Eigenmann

Gilbertella Eigenmann, Smithsonian Misc. Coll. **45**: 147. 1903 (Genotype: *Anacyrtus* (*Raestes*) *alatus* Steindachner.)

Gilbertolus Eigenmann, *in* Eigenmann and Ogle, Proc. U. S. Nat. Mus. **33**: 3. 1907. (New name to replace *Gilbertella* Eigenmann, preoccupied.)

KEY TO THE SUBSPECIES OF GILBERTOLUS ALATUS

1*a*. Pores in lateral line 58 or 59; pectoral rays usually i,17; black caudal spot barely extending on base of middle rays of caudal fin (see table for counts) (Magdalena Basin)..... *G. a. alatus* (Steindachner)[2]

1*b*. Pores in lateral line to base of caudal fin rays 63 to 68; pectoral rays usually i,16; black caudal spot extending on base of caudal fin rays as far as on caudal peduncle (Maracaibo Basin)..... *G. a. maracaiboensis*, n. subsp.

1*c*. Pores in lateral line 69 to 74; pectoral rays usually i,17; black caudal spot not extending on base of caudal fin rays, becoming less distinct in larger specimens (Atrato Basin)..... *G. a. atratoensis*, n. subsp.

Gilbertolus alatus maracaiboensis, n. subsp.

Holotype.—U.S.N.M. no. 121386, a female specimen, 120 mm in standard length, collected by Leonard P. Schultz, March 11, 1942, in a caño half a mile west of Sinamaica, Estado de Zulia, Venezuela.

Paratypes (all collected by author).—U.S. N.M. no. 121387, 4 specimens, 107 to 126.5 mm, taken along with the holotype and bearing the same data; U.S.N.M. no. 121388, 1 example, 61 mm, February 24, 1942, from the Río Socuy, 3 km above its mouth, Maracaibo Basin; U.S.N.M. no. 121389, 1 specimen, 75 mm, March 2, 1942, from the Río Negro below mouth of Río Yasa, Maracaibo Basin.

Description.—This description is based on the holotype and six paratypes. Detailed meas-

[1] Published by permission of the Secretary of the Smithsonian Institution. Received April 22, 1943.

[2] *Anacyrtus* (*Raestes*) *alatus* Steindachner, Denkschr. Akad. Wiss. Wien **39**: 65. 1878 (Río Magdalena).

urements were made on the holotype and a paratype, and these data, expressed in hundredths of the standard length, are recorded below, respectively.

Standard length, in mm, 120 and 107. Length of head 24.3 and 25.0; greatest depth of body 37.5 and 35.5; length of snout 5.42 and 6.08; diameter of orbit 7.66 and 7.94; least width of fleshy interorbital 6.50 and 6.52; postorbital length of head (to most posterior tip of operculum) 11.9 and 12.1; tip of snout to rear edge of maxillary 12.8 and 13.8; distance from base of last anal ray to midbase of caudal fin 10.1 and 9.82; least depth of caudal peduncle 10.1 and 9.82; length of anal fin base 40.6 and 44.0; length of longest anal fin ray 14.6 and 13.6; longest dorsal ray 17.1 and 18.0; longest pectoral (first) 35.4 and 37.6; longest pelvic ray 15.0 and 15.1; length of upper caudal lobe 24.2 and —; and of lower lobe 26.3 and —; tip of snout to dorsal origin 57.9 and 58.2; snout to anal origin 57.5 and 56.6; snout to adipose 87.5 and 86.0; snout to pelvic insertion 44.6 and 44.5; snout to pectoral insertion 26.9 and 28.5; distance between tip of supraoccipital process and dorsal origin 39.7 and 39.3; snout to tip of supraoccipital process 19.0 and 19.6.

The following counts were made, respectively: Dorsal rays ii,9 and ii,9; anal rays iv,40 and iv,45; pectorals i,16–i,16 and i,16–i,16; pelvics i,7–i,7 and i,7–i,6; pores in lateral line to base of caudal fin rays 68 and 65; scales above lateral line to origin of dorsal 14 and 13 and below lateral line to pelvic fin base 13 and 11; scales in a zigzag row around caudal peduncle 21 and 22; scale rows in front of dorsal to tip of supraoccipital process 42 and 41; branched caudal fin rays 17 and 17; gill rakers on first gill arch — and 8 +1 +15.

Body compressed, the greatest depth usually through region of anus and contained a little less than 3 times in standard length, head about 4, base of anal fin about 2½, both in standard length; eye large, much longer than snout, about 3, interorbital about 4½, mouth (snout to rear of maxillary) 2, all in length of head; mouth equal to snout and eye; origin of dorsal an equal distance between midbase of caudal fin rays and front margin of the opercular bone; origin of anal a little in advance of dorsal origin, the latter over the base of the fourth branched anal ray; pelvic insertions a little closer to rear of pectoral bases than to anal origin; ventral margin sharply keeled from in front of anal fin to between rear bases of pectorals, thence a hard low ridge ending at isthmus; lateral line a little decurved behind head, thence following a straight course to one scale row below midbase of caudal fin; length of caudal peduncle equal to its least depth; palatine bones forming an elevated ridge but edentulous; premaxillaries with a pair of canines at their symphysis, then seven pairs of short sharp-pointed conical teeth laterally; maxillaries with a series of sharp-pointed conical teeth; teeth in both jaws in a single series; dentaries with two pairs of long canines, the outer pair fanglike; two pairs of short conical teeth between the inner pair of canines; dentaries behind outer pair of canines with a series of widely spaced conical teeth; canines on lower jaw fitting into pits in upper jaw; lower lobe of caudal fin longer than upper lobe; caudal fin deeply concave or forked; first rays of all fins longest; the first pectoral rays are exceedingly elongate, reaching past anal origin to a vertical line through dorsal origin; pelvics reaching not quite so far; anal origin a little closer to tip of snout than midcaudal base; pectoral fin lanceolate in shape; dorsal fin rather short, about equal to eye and postorbital length of head; breast is thick and heavy, the width across prepectoral shields about equal to two eye diameters, and it is the widest part of the body; prepectoral shield with a notch; lower angle of preopercular bone with a short flat, spinelike projection posteriorly; the second suborbital does not quite cover two-thirds of the cheek, and the remainder is fleshy; the gill rakers are rather long and slender, numbering 7 or 8 +1 +14 or 15.

Color.—Silvery on sides, back darker; the black caudal spot extends as much on the basal portion of the caudal fin rays as on caudal peduncle, and is a little larger than pupil; margin of thick lower lip blackish; membranes of fins pigmented, the rays less so; in the two smaller specimens a lateral dark band occurs above lateral line, ending in the black caudal spot; peritoneum silvery.

Remarks.—Among other characters this new subspecies differs from the other two forms referred to the genus *Gilbertolus* as indicated in the key. Named *maracaiboensis* in reference to the Maracaibo Basin in which specimens have been collected.

Gilbertolus alatus atratoensis, n. subsp.

Gilbertolus alatus Eigenmann (not of Steindachner), Mem. Carnegie Mus. 9(1): 164, pl. 26, fig. 1. 1922.

Holotype.—U.S.N.M. no. 76976, a specimen 91 mm in standard length, collected by Wilson at Quibdo, Río Atrato, Colombia.

Paratypes.—U.S.N.M. no. 120170, 14 specimens, collected along with the holotype and bearing same data.

Description.—Detailed measurements were made on the holotype and one of the paratypes. These data, expressed in hundredths of the standard length, are recorded below, respectively.

Standard length, in mm, 91 and 87.4. Length of head 25.9 and 24.7; greatest depth 35.2 and 35.3; length of snout 6.04 and 5.95; diameter of orbit 9.67 and 9.16; least width of fleshy interorbital space 6.15 and 6.30, postorbital length of head 12.1 and 11.2; tip of snout to rear of maxillary 13.0 and 13.5; length of caudal peduncle 9.78 and 9.72; least depth of caudal peduncle 9.34 and 9.84; length of base of anal fin 42.4 and 42.6; length of longest ray of anal — and 17.2; longest dorsal ray 18.7 and 18.1; longest pectoral ray 35.3 and 36.4; longest pelvic ray 11.9 and 12.2; length of upper caudal lobe 24.2 and —; lower caudal lobe 28.6 and —; tip of snout to dorsal origin 57.9 and 57.0; snout to anal origin 57.2 and 55.2; snout to adipose origin 87.5 and 87.0; snout to pelvic insertion 47.8 and 45.4; snout to pectoral insertion 29.7 and 28.6; distance from tip of supraoccipital process to dorsal origin 37.4 and 36.7; snout tip to posterior point of supraoccipital process 20.8 and 20.3.

The following counts were made, respectively: Dorsal rays ii,9 and ii,9; anal rays iv,43 and iv,46; pectoral i,17–i,17 and i,17–i,17; pelvics i,7–i,7 and i,7–i,7; pores in lateral line 72 and 71; scales from dorsal origin to lateral line 13 and 13, and from lateral line to pelvic base 12 and 13; zigzag row of scales around caudal peduncle 21 and 22; number of gill rakers on first gill arch 8+1+15 and 7+1+14; number of scale rows from tip of supraoccipital process to dorsal origin — and 41; branched caudal fin rays 17 and 17.

It is unnecessary to describe this subspecies as fully as *maracaiboensis*, as it is very similar in all except the following respects: Dorsal origin equidistant between midcaudal base and rear or orbit; the notch in prepectoral shield is much shallower, so that there is hardly any platelike projection at the lower angle; the spiny platelike projection at lower preopercular angle is shorter, so that there is only an indication of a shallow notch above it; the pectorals reach a little past a vertical through dorsal origin.

Color.—Caudal spot does not extend out on basis of middle caudal fin rays; otherwise color is the same as in *maracaiboensis*.

Remarks.—This new subspecies may be distinguished from other subspecies referred to the genus *Gilbertolus* by means of the key.

Named *atratoensis* in reference to the river system in which it occurs.

TABLE 1.—COUNTS RECORDED ON THE SUBSPECIES OF GILBERTOLUS ALATUS (STEINDACHNER)

Subspecies	Number of fin rays																			
	Anal											Pectoral				Pelvics		Dorsal	
	iv,40	iv,41	iv,42	iv,43	iv,44	iv,45	iv,46	iv,47	iv,48	iv,49		i,15	i,16	i,17	i,18	i,6	i,7	ii,8	ii,9
atratoensis	—	—	—	2	1	4	2	4	—	1		—	—	18	1	—	10	—	11
maracaiboensis	1	—	—	—	4	2	—	—	—	—		2	11	1	—	1	8	1	6
alatus	—	—	—	—	—	—	—	—	—	1		—	—	1	—	—	1	1	—

Subspecies	Number of scales																							
	Number of pores in lateral line																Above lateral line					Below lateral line to pelvic base			
	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	12	13	14	15	16	10	11	12	13
atratoensis	—	—	—	—	—	—	—	—	—	—	—	1	5	3	3	2	1	—	1	6	3	1	—	1	4	6
maracaiboensis	—	—	—	—	—	2	1	2	—	1	1	—	—	—	—	—	—	2	1	2	—	—	—	3	1	1
alatus	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	1	—	—	—

ZOOLOGY.—*Two new ostracods of the genus* Entocythere *and records of previously described species.*[1] C. CLAYTON HOFF, Quincy College, Quincy, Ill. (Communicated by CLARENCE R. SHOEMAKER.)

At the time of publication of the writer's previous paper (1942) establishing the subfamily Entocytherinae of cytherid ostracods and describing two new species of the genus *Entocythere* epizoic on crayfishes, it seemed apparent that further examination of crayfishes would reveal other undescribed species of the group. At that time the writer had in his possession a few poorly prepared specimens of an undescribed species of the genus *Entocythere*. Upon examination of large numbers of specimens taken in recent collections, this undescribed form has been found in sufficient numbers to merit description. The present paper describes this as a new species, as well as a second new species. The opportunity is taken here to list records of previously described species of *Entocythere* from crayfishes collected in several States of the lower Mississippi Valley.

The bulk of material upon which this study is based was obtained from crayfishes collected by the writer during the spring of 1942 from areas in Illinois, Tennessee, Louisiana, and Arkansas. The crayfishes obtained from Tennessee were collected with the assistance of Prof. C. L. Baker while the writer was working at the Reelfoot Lake Biological Station under a research grant from the Tennessee Academy of Science. The crayfishes from Illinois were identified by the writer, and all the others were identified by Dr. Horton H. Hobbs, Jr., University of Florida. This study was aided by a grant from the American Association for the Advancement of Science through the Illinois State Academy of Science.

For a discussion of the ostracods epizoic on crayfishes and diagnoses of the subfamily Entocytherinae, the genus *Entocythere*, and the subgenera of the latter, the reader is referred to the paper by Hoff (1942).

Entocythere (Cytherites) riojai, n. sp.

Fig. 1

The type material was taken from several crayfishes of the species *Orconectes virilis* (Hagen) collected from a stream in South Park, Quincy, Adams County, Ill., on April 18, 1942. Holotype (female), allotype, and a number of paratypes, U.S.N.M. 81292. Additional paratypes have been retained provisionally in the writer's collection. The female selected as holotype was taken while in copulation, the male of the pair being the allotype. The paratypes include both gravid and copulating females, since the two kinds differ in several ways. It might appear inadvisable to select as the holotype a copulating, nongravid female rather than a gravid one, but, when the male and female of a copulating pair are selected as the first types, there is little possibility of designating as holotype and allotype individuals of different species.

This new species is named in honor of Dr. Enrique Rioja, an outstanding Mexican taxonomist, who has recently described two new species of the genus *Entocythere* (Rioja, 1940, 1942). Dr. Rioja was the first to discover the presence of two kinds of females in species of the genus *Entocythere*.

Female. The shell (Fig. 1, *A*) of the copulating female is ovate-oblong in general shape, with little irregularity in outline as seen from the side. The anterior end is more narrowly rounded than the posterior, since the greatest height is near the center of the posterior one-half of the shell. The dorsal margin is weakly convex, while the ventral margin presents a shallow concavity at about the anterior one-third. In some individuals this concavity is so poorly developed that the ventral margin is practically straight. Posterior to the concavity the ventral margin is slightly convex. The very fine marginal hairs of the shell are few in number and are evenly spaced along the ventral and end margins of the shell. The anterior one-third of the shell is unmarked and transparent. The posterior two-thirds, the part beginning a short distance posterior to the eye, is usually marked by very fine pits and colored by aggregations of pigment flecks. These flecks are often concentrated in two areas: one near the center of the dorsal margin extending ventrally toward the center of the shell and the other

[1] Received April 20, 1943.

close to the posterior margin of the shell. In a few individuals the flecks have been observed to cover most of the posterior two-thirds of the shell, but, even in this case, there are always concentrations of pigment in the two areas already described. The eye is large in all individuals and is located about one-fifth of the distance from the anterior end of the shell.

Below are given measurements of several shells of copulating females cleared in xylol and mounted in clarite. These measurements are of females found in copulation at the time of capture.

Length	*Height*	
0.35 mm	0.19 mm	(holotype)
0.34	0.19	(paratype)
0.35	0.19	(paratype)

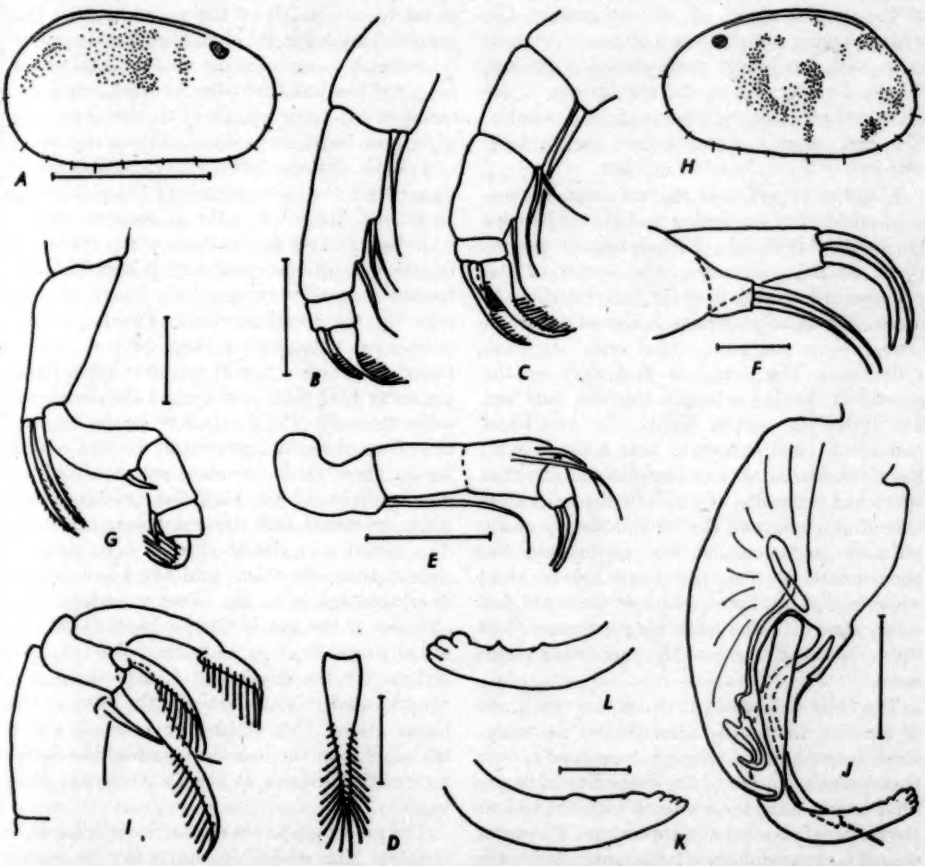

Fig. 1.—*Entocythere riojai*, n. sp.: *A*, Shell of female holotype as viewed from the right; *B*, distal part of antenna of copulating female paratype; *C*, distal part of antenna of gravid female paratype; *D*, ventral claw of the antenna of a male paratype seen from the flexor side; *E*, lateral view of the mandibular palp of a gravid female paratype; *F*, mesial view of the maxillary palp and protopodite of a gravid female paratype; *G*, lateral view of first leg of gravid female paratype; *H*, shell of male allotype viewed from the left; *I*, mesial view of the distal portion of the antenna of a male paratype; *J*, mesial view of the copulatory organ of the left side of a male paratype; *K*, the distal end of the "clasping appendage" of the male allotype; *L*, the distal end of the "clasping appendage" of a male paratype.

All figures were drawn from specimens mounted in clarite. A camera lucida was used. The scale in *A* equals 0.2 mm and applies also to *H*. The scale in *B* equals 0.02 mm and applies as well to *C*. The scale in *D* equals 0.01 mm and applies also to *I*. The scale in *E* equals 0.025 mm; that of *F*, 0.01 mm; that of *G*, 0.025 mm; and that of *J*, 0.025 mm. The scale in *K* is equal to 0.01 mm and also applies to *L*.

Measurements of females from other localities show considerable variation in shell size, with a tendency in many cases for the shells to be somewhat smaller than those of the type collection.

The shell of the gravid female is very similar to that of the copulating type already mentioned, except that the concavity of the ventral margin is much more pronounced and the size of the shell is about 10 percent greater, the length ranging from 0.35 to 0.40 mm or slightly more with the height proportional. Eggs can usually be observed in the gravid type of female but were not seen in copulating females. The eggs range in number from one to four, with two or three the usual number.

With the exception of the antennae, the appendages of the copulating and gravid females are identical in nature. Each antennule is composed of six podomeres. The width of the podomeres decreases in order from proximal to distal. The third podomere is almost square in lateral view, the more distal ones becoming cylindrical. The terminal podomere is the slenderest, having a length between four and five times the central width. The two basal podomeres each appear to bear a single seta; the third two setae; the fourth five somewhat shortened setae, few of which in any individual extend much beyond the level of the tip of the ultimate podomere of the appendage; the penultimate or fifth podomere has no seta; while on the ultimate podomere there are five setae, none of which has a length greater than three times the length of the supporting podomere.

The chief differences between the two kinds of females are to be found in the antennae. Each antenna in the female is composed of four podomeres exclusive of the exopodite or flagellum, which extends to a level with the end of the terminal claws of the appendage. The antepenultimate podomere of the antenna or the first podomere of the endopodite bears on the flexor-distal corner a long, heavy seta, which extends nearly to the level of the origin of the most distal seta of the penultimate podomere. The penultimate podomere of the copulating female (Fig. 1, *B*) is undivided, but in the gravid female (Fig. 1, *C*) a division occurs, so that the antenna appears to be formed of five podomeres, exclusive of the exopodite. In the copulating female the penultimate podomere has three setae, two forming a pair near the center on the ventral or flexor surface of the appendage and the third a short distance from the distal margin on the flexor surface. The most distal seta of the penultimate podomere has a length somewhat greater than the central width of the podomere, while each seta of the more proximally situated pair has a length about equal to the width of the podomere. In the gravid female the divided penultimate podomere bears a pair of setae on the distal-flexor corner of the basal portion. Another seta is located on the flexor margin of the distal portion about one-third of the distance from the distal end. Each of these three setae is as long as or longer than the basal portion of the podomere. In general, the setae of the antenna are somewhat longer in the gravid than in the copulating female. The ultimate podomere in both kinds of females is small, serving merely as articulation area for the terminal claws. The copulating female has two claws, a large ventral or posterior claw with a row of spinelike teeth passing along both sides and around the distal end as in the male (Fig. 1, *D*), having the appearance from the side, however, of a single row of teeth. These teeth or spines are stout on the distal portion of the claw but become somewhat shortened and weakened near the base. The anterior or dorsal claw is very slender, shorter than the other, and has a few poorly developed spines on the concave surface. The antenna of the gravid female bears three terminal claws, since in addition to the two described for the copulating female there is a third located mesially between the bases of the larger claws. This third claw is small and a little less than one-half the length of the dorsal claw of the antenna. It bears a few weak, short teeth.

The mouth parts are similar in both kinds of females. The mandibles have five to seven, usually six, flattened, spatulalike, multiple-cusped teeth. Two or three small additional teeth may be found in some individuals. The most distal tooth is much wider than the others and has six or seven cusps; the more proximal teeth being progressively smaller and exhibiting fewer cusps. The respiratory plate is reduced to three setae. The palp (Fig. 1, *E*) is composed of four podomeres. The joint between the basal

and the next or antepenultimate podomere of the palp is, however, weakly expressed, while the suture between the antepenultimate and the penultimate podomeres can not be discerned except under optimum conditions. The distal-flexor margin of the basal podomere supports a long, curved seta reaching to the distal end of the ultimate podomere; the antepenultimate podomere has no setae; the penultimate has two setae, a short one near the distal-extensor corner and a somewhat laterally placed longer seta originating from the anterior one-third of the podomere; the ultimate podomere bears terminally a heavy, slightly curved spine at the base of which is inserted a heavy seta nearly equal in length to the length of the spine. The maxilla (Fig. 1, *F*) has an unjointed palp extending far beyond the distal end of the protopodite and ending in two claw-like spines, each falciform, but the ventral one slightly longer and heavier than the other. The two are nearly parallel throughout their length. The base or protopodite ends in two long, stiffened setae, each somewhat longer than the terminal spine of the palp. The respiratory plate usually has 17 setae or rays, although it is very difficult to make an accurate count since the long and slender setae are extremely transparent and can be seen only in preparations made and examined with more than ordinary care. In the case of dissections the respiratory plate is often pulled loose from the protopodite, since the attachment is by a very slender basal stalk. For these reasons the respiratory plate easily may be overlooked.

Each of the three thoracic legs is composed of four podomeres. The first thoracic leg (Fig. 1, *G*) has two plumose setae at the anterior-distal corner of the first podomere. These setae are nearly equal in length, each being almost as long as the next more distal podomere. A single slightly plumose seta is found at the anterior-distal corner of the basal podomere of each leg of the second and third pairs. Each seta has a length not much more than one-half of the length of the antepenultimate podomere. The second podomere of each leg bears a single seta on the anterior margin of each leg a short distance removed from the distal margin. The length of this seta shows considerable variation but in general is not less than one-half of the width of the podomere at the base of the seta or more than the width of the podomere. The penultimate podomere is distally somewhat widened and meets the ultimate podomere in a poorly marked, probably little movable, joint. The penultimate podomere of each leg bears on the anterior distal corner a seta that has a length approximate to the length of the ultimate podomere. This seta is often so closely appressed to the anterior margin of the distal podomere that it is seen with difficulty. The ultimate podomere of each leg is wider than long. When the terminal claw is flexed the seta of the penultimate podomere contacts the teeth or spines of the terminal claw. Each of the terminal claws bears, on the average, five long teeth.

Male.—Shell of the male (Fig. 1, *H*) differing from that of the copulating female only by a ventral margin slightly convex throughout its length and a posterior margin flattened along the dorsal one-half. The measurements of several males mounted in clarite are as follows:

Length	*Height*	
0.33 mm	0.18 mm	(allotype)
0.34	0.18	(paratype)
0.32	0.18	(paratype)
0.37	0.19	(paratype)

The appendages differ in a few respects from those of the female. The chief difference between individuals of the two sexes is in the antenna, which in the male is modified for clasping the female during copulation. As in the gravid female, the penultimate podomere of the antenna is divided so that the appendage has five apparent podomeres. The setae of the antenna are placed in the same position but are relatively shorter than those of the gravid female. Like the gravid female, there are three end claws (Fig. 1, *I*). These claws are slightly longer than in the gravid female, the ventral claw especially being slenderer and lacking the bulbose basal portion observed in the corresponding claw of the gravid female. The anterior dorsal claw has a length equal to about three-fourths of the length of the longer but slenderer ventral claw. This dorsal claw is heavy throughout its length, is gently curved, and ends distally in a flattened, widened area, which bears a circular row of long teeth or spines that pass around the sides and end, the teeth appearing in side view like the teeth of a comb. The small mesial claw has a length equal

to about one-half of the anterior or dorsal claw. The mouth parts of the male are similar to those of the female. The thoracic legs differ only in the relative lengths of some of the setae, of which those of the antepenultimate podomeres seem usually to be longer in the male than in the female, each having a length greater than the width of the leg at the base of the seta.

The copulatory organ (Fig. 1, *J*) in the male consists of a base and three accessory pieces. The base is proximally widened but abruptly narrowed near the center of the anterior margin at the point of attachment of the accessory pieces. The most dorsal of the three accessory pieces has a short base and a single straight distal seta almost equal in length to the base. The next or center accessory piece is long and slender, being curved at each end but more or less straightened centrally. This accessory piece ends in a seta equal in length to the seta of the first accessory piece. The third or most distal accessory piece (Fig. 1, *K* and *L*) is heavy and falciform. This structure is often called the "clasping appendage." The end of this accessory piece is blunt and distally marked by three or four rounded teeth. The concave margin is toothed with usually two, rarely three, widely separated, almost papilla-form teeth. The "clasping appendage" extends for some distance beyond the base of the copulatory organ.

Remarks.—At the present time, it would be difficult to attempt a discussion of the natural relationships of the species in the subgenus *Cytherites* Sars, 1926, especially since the male of *Entocythere* (*Cytherites*) *insignipes* (Sars, 1926), the type of the subgenus *Cytherites*, is unknown. The subgenera of the genus *Entocythere* seem poorly defined, and the entire classification of forms within the genus needs to be reviewed. It is even difficult now to indicate in some of the species a convenient combination of characteristics that might serve as a basis for rapid recognition. Except on the basis of the characteristics of the "clasping appendage" of the male copulatory organ, many of the species of the subgenus may be accurately separated from one another only by careful and detailed study. In the various species of the genus *Entocythere*, there are a few characteristics which, when carefully applied, serve to separate other species from *E. riojai*. As an aid to future work, a list of the known species of the genus is given here along with an indication of the way in which each may be separated from *E. riojai*.

Entocythere cambaria Marshall, 1903, *E. illinoisensis* Hoff, 1942, and *E. claytonhoffi* Rioja, 1942, differ from *E. riojai* by being much greater in shell length, about 0.60 mm, and by having fewer setae in the respiratory plate of the maxilla. These forms have been assigned to the subgenus *Entocythere* Marshall, 1903, as diagnosed by Hoff (1942).

E. insignipes (Sars, 1926) differs from *E. riojai* by having seven podomeres and three terminal setae in the antennule, while the latter has six podomeres and five terminal setae. The male copulatory organ of *E. insignipes* is undescribed, the original description of the species being based entirely upon female specimens.

Both *E. heterodonta* Rioja, 1940, and *E. donnaldsonensis* Klie, 1931, differ from *E. riojai* by the absence of a seta on the penultimate podomere of each thoracic leg. Neither species has a long, falciform "clasping appendage" with a regular, entire convex surface that could be confused with that structure in *E. riojai*.

E. columbia Dobbin, 1941, is easily separated from *E. riojai* by the size, about 0.60 mm in length, and the peculiar shape of the shell. There are also fewer setae in the respiratory plate of the maxilla according to a personal communication from Dr. Dobbin (Evenson). The "clasping appendage" is less curved than in *E. riojai*.

E. copiosa Hoff, 1942, may be separated with difficulty from *E. riojai* except by the "clasping appendage," which in the former has the convex margin subdistally divided in contrast to the entire convex surface of that structure in *E. riojai*. Also *E. copiosa* is slightly larger; the setae of the respiratory plate of the maxilla are stronger and more easily seen; and the teeth of the ventral claw of the antenna are usually weaker. These last characteristics are not, however, in every instance entirely dependable for separation of the two species.

E. humesi, the second species described as new in this paper, is much larger than *E. riojai* and has four terminal setae on the antennule and only two setae representing the respiratory plate of the mandible. The clasping appendage is not so long or curved as in *E. riojai*.

The problems of intrageneric and inter-

generic relationships in the Entocytherinae and the identification of species are further complicated by the occurrence in some species, as in *E. riojai*, of two kinds of females: the copulating and the gravid. Dr. Rioja in a personal communication to the writer has mentioned the presence of two kinds of females in a species of *Entocythere* from Mexico. Paris (1920) mentions two types of females, "nubile" and "ovigère," in the European species *Sphaeromicola topsenti* Paris, 1916, but does not discuss the two kinds in detail or account for their occurrence. Paris points out the shell differences, especially the increased size and angularity of the shell of the "ovigère" type of female, but mentions no differences in the antennae of the two kinds of females. In *E. riojai* the copulating females have the penultimate podomere of the antenna undivided and the antenna ending in two claws, while the gravid females have a divided penultimate podomere and three antennary claws.

An exact explanation of the occurrence of the two types of females can not be given at this time. In observations made on about 75 adult individuals, the majority of them females, it was noticed that all the females found in copulation were characterized by an undivided penultimate podomere in the antenna and two end claws. These have been designated as copulating females. None were observed in a gravid condition. On the other hand, practically all the larger females with the divided penultimate podomere and three end claws on the antenna were found to be carrying large, well-formed eggs. The females of this type never were observed in copulation.

On first noticing the two kinds of females, the writer supposed that he had discovered a case of parthenogenesis, since this phenomenon would explain the occurrence of copulation in the one kind of female and not in the other. Parthenogenetic development is known in many fresh-water ostracods, being common in species of the family Cypridae, but a morphological difference as exhibited here between females of the two kinds apparently is unreported. Observation does not substantiate the hypothesis that there is one type of female producing eggs requiring fertilization before development and another kind producing eggs developing without fertilization, since, if the hypothesis held, eggs should be observed in at least a few of the smaller females. Such eggs have not been found. The only adequate explanation for the two kinds of females seems to be that a molt occurs between the time of copulation and the time of development of the eggs within the ovary. At the time of this molt there appear the three claws and the divided penultimate podomere of the antenna as characteristic of the larger, gravid female. Whether this explanation is the correct one can be determined only by observation of the development of females in culture. Unfortunately, methods of culturing the epizoic ostracods are as yet undeveloped.

Ecology.—The lack of host specificity in the relationship between *E. riojai* and different species of crayfishes supports the writer's (1942) former observations. Three different species of crayfish are reported as being hosts to *E. riojai* in the six collections. These crayfish species are given in the paragraph on distribution.

In the six collections made of *E. riojai*, the species was found associated twice with *E. copiosa* and four times with *E. illinoisensis*. By this association is meant the finding of ostracods from the crayfishes of one collection and not from the same crayfish, since all the crayfishes of a collection are examined together as a single lot. *E. riojai* was found alone in two collections, but the absence of other forms from these two collections may be the result of small samples.

A review of the habitats, from which the material was secured, reveals the interesting fact that *E. riojai* has been found only on crayfishes from small streams where there is considerable current and never from the quiet waters of lakes or the larger, more slowly flowing streams. Large numbers of collections from different areas may make possible some interesting ecological deductions with reference to this and other species of *Entocythere*.

Distribution.—In addition to the type locality, where the species is very abundant, *E. riojai* has been found in collections as follows: a few individuals from *Orconectes virilis* (Hagen), Salt Fork at Homer Park, near Homer, Champaign County, Ill., on May 23, 1940; a few individuals from *Orconectes propinquus* (Girard) from Stony Creek, Oakwood, Vermilion County, Ill., September 19, 1940; a few individuals from *Orconectes propinquus*

(Girard) taken from the stream in Crystal Lake Park, Urbana, Champaign County, Ill., October 2, 1940; a number of individuals taken from *Orconectes longimanus* (Faxon) in a stream near Casa, Perry County, Ark., June 17, 1942; several individuals from *Orconectes meeki* (Faxon) from a stream near Crossroads, Pulaski County, Ark., on June 17, 1942.

Entocythere (Cytherites) humesi, n. sp.

Fig. 2

The type material was secured from a single slightly atypical male crayfish of the species *Cambarus bartonii robustus* Girard collected by Dr. Arthur G. Humes from a stream near Boston, Erie County, N. Y., on May 17, 1942. Holotype (female), allotype, and one paratype (female), U.S.N.M. 81293. Four paratypes, one male, one female, and two immature individuals, have been retained in the collection of the writer. This species is named in honor of the collector, Dr. Arthur G. Humes.

Female.—Shell from the side (Fig. 2, *A*) subreniform, with the posterior end higher and more broadly rounded than the anterior. The ventral margin of the shell has a shallow concavity deepest just behind the anterior one-third of the shell, while the posterior one-half of the ventral margin is weakly convex. The anterior end of the shell is narrowly rounded. The anterior margin meets the dorsal margin without interruption except for a slight indentation just ventral to the junction of the two margins. The dorsal margin is strongly arched with the highest point or apex located between the center and the posterior one-third of the margin. From the apex the dorsal margin slopes in an even arc both anteriorly and posteriorly. The posterior margin is dorsally somewhat flattened but ventrally rounded, meeting the ventral margin without angulation. In juvenile individuals a distinct protuberance or angulation is located at the posterior-ventral corner of the shell. The eye is well developed, is easily observed through the transparent valves, and is located near the anterior one-fifth of the shell. The valves appear asetaceous and show no important shell sculpturing. Poorly developed, scattered areas of pigment occur, however, on the dorsal one-half of each valve posterior to the eye. A more complete description of the shell is at present impossible because the material available for study is limited. Some indication of the shell size is shown by the following measurements of a gravid female paratype: length of shell, 0.50 mm; height at level of ventral concavity, 0.24 mm; greatest height, 0.29 mm.

With respect to the cephalic appendages, each antennule is composed of six podomeres. The first or basal podomere is heavy; the second has a length little less than twice the width; the third has a length about one and one-half times the width; the fourth or antepenultimate podomere is about twice as long as wide; the penultimate about as long as the antepenultimate but much slenderer; the ultimate is six to seven times as long as wide, with a length approximate to that of the next more proximal podomere. The basal podomere appears to bear a single seta on the ventral-distal corner, while the distal seta of the second podomere is somewhat mesial in position. The third podomere supports two setae. The antepenultimate podomere has four distal setae, one on the flexor margin and one on the extensor margin, with the other two mesial in position. These setae are long, some of them reaching slightly beyond the base of the terminal setae of the appendage. The fifth or penultimate podomere does not bear setae, but four terminal setae are located on the ultimate podomere of the antennule. The antennae closely resemble the antennae of several other species of the subgenus *Cytherites* Sars, 1926, each being composed of four podomeres, exclusive of the exopodite, and ending in two claws (Fig. 2, *B*). The penultimate podomere is undivided. The anterior or dorsal terminal claw is weak, with the teeth so poorly developed that they are seen only with great difficulty. The ventral claw is the larger, is proximally bulbose, and has a comblike row of long teeth along the distal two-thirds of the claw. The penultimate podomere of the antenna has a length nearly equal to three times the average width of the podomere and bears three setae on the flexor or ventral margin. One of these is removed a short distance from the distal end of the podomere, and the other two form a pair slightly anterior to the center. Each has a length almost equal to the width of the podomere at the base of the seta. The seta of the flexor-distal corner of the antepenultimate podomere has a heavy basal por-

tion and does not reach the level of the origin of the most distal seta of the penultimate podomere. The antepenultimate or second podomere of the antenna (the basal podomere of the endopodite) has a distal width approximate to the length of the ventral margin. The flagellum or exopodite reaches to the level of the terminal claws of the endopodite. The protopodite of the mandible bears six spade-like or spatulaform teeth, the mesial two usually being longer than the others and having a single cusp, while the more laterally placed teeth are multicusped, the outside one having six well-developed denticles or cusps. In some instances a small but rudimentary additional tooth may be found mesial to the others, thus making seven teeth in all. A short distance proximal to the teeth the protopodite bears a short, heavy seta on the convex or anterior surface. This seta is directed toward the distal end of the protopodite. The respiratory plate is represented by two setae: one more than one-third as long as the mandibular palp, the other about one-fourth the length of the palp. In some individuals one of these setae appears to be directed mesially, usually closely appressed to the protopodite, while the shorter of the two setae often stands erect. These setae are fleshy in appearance, the bases being widened, and they appear to originate from a small papilla. The mandibular palp (Fig. 2, *C*) of four podomeres extends distally beyond the protopodite. In this palp the juncture of the basal and second podomere is not well marked but can be located by noticing the origin of the seta at the distal-flexor corner of the basal podomere. This seta reaches the level of the ultimate podomere of the palp. The straight basal two-thirds of the seta is often directed parallel to the flexor margin of the palp, while the distal one-third is evenly curved. The probably inarticulate juncture of the antepenultimate or second and the penultimate or third podomere is too weak to be easily observed. On the anterior face, slightly removed from the distal end of the penultimate podomere, is a gently curved seta extending almost to the tip of the terminal spine of the ultimate

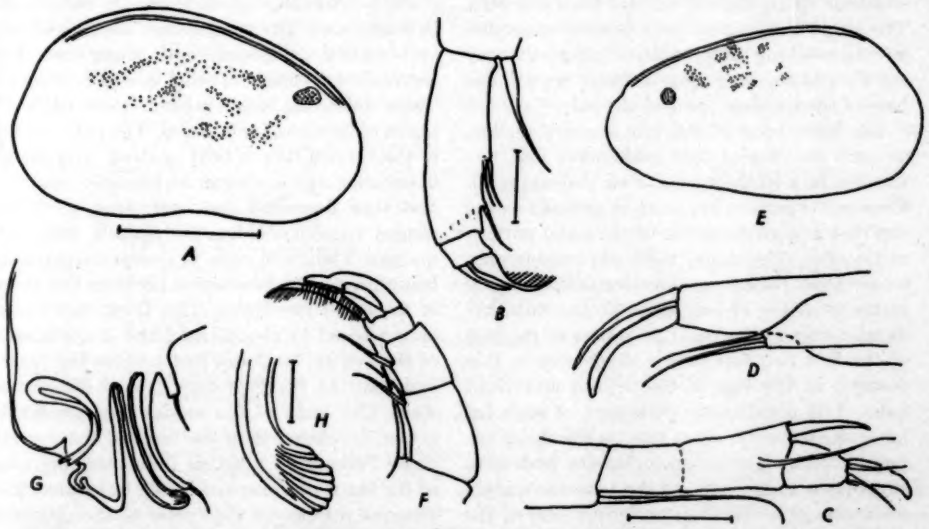

Fig. 2.—*Entocythere humesi*, n. sp.: *A*, Shell of a female paratype as seen from the right side; *B*, mesial view of the distal end of the endopodite of the antenna of a female paratype; *C*, anterior view of the mandibular palp of the holotype; *D*, mesial view of the masticatory process and the maxillary palp of a female paratype; *E*, shell of male allotype viewed from the left side; *F*, mesial view of the endopodite of the antenna of male allotype; *G*, lateral view of the distal end of the copulatory organ of male allotype; *H*, end of "clasping appendage" of male allotype.

All figures were drawn with the aid of a camera lucida from specimens mounted in clarite. The scale for *A* equals 0.2 mm and applies also to *E*. The scale for *B* equals 0.025 mm and applies as well to *F* and *G*. The scale for *C* equals 0.02 mm and may be applied to *D*. The scale for *H* is equal to 0.01 mm.

podomere, while at the extensor-distal corner of the same podomere is a sharply pointed, spinelike seta whose tip extends slightly beyond the distal end of the ultimate podomere. The terminal podomere is distally narrowed and has a flexor margin whose length is slightly greater than the basal width of the podomore. In addition to the heavy terminal spine, which is curved near the tip, the ultimate podomere bears two fine setae originating beneath the base of the spine. The spine has a length somewhat greater than the length of the extensor margin of the ultimate podomere, while each seta is somewhat shorter. In Fig. 2, *C*, the terminal podomere of the mandibular palp is shown slightly rotated to expose the two terminal setae, which are difficult to distinguish as separate setae when observed in lateral or mesial view. The maxilla (Fig. 2, *D*) includes a single masticatory process, an unsegmented palp, and a respiratory plate bearing 16 rays or setae. The unsegmented palp ends in a heavy but gently curved spine along the convex side of which runs a second similarly curved but slenderer spine, slightly shorter than the first. The single masticatory process terminates distally in two long setae, each curved gently near the tip and reaching some distance beyond the base of the terminal spine of the palp.

The three pairs of thoracic legs are similar, as each consists of four podomeres and terminates in a sickle-shaped claw displaying on the concave surface five teeth in addition to the one that is a continuation of the basal portion of the claw. The center teeth are considerably longer than the others. The legs differ chiefly in the presence of two setae at the anterior-distal corner of the basal podomere of the legs of the first pair but only a single seta in this position in the legs of the second and third pairs. The penultimate podomere of each leg has a single heavy, short seta on the distal anterior corner. The antepenultimate podomere supports a single seta on the anterior margin somewhat removed from the distal end of the podomere.

Male.—The shell of the male (Fig. 2, *E*) is similar in general shape to that of the female except that the concavity of the anterior portion of the ventral margin seems to be more weakly developed and may be so nearly wanting that the ventral margin appears practically straight. Redescription with an indication of the limits of variability of shell size and shape will be advisable when additional material can be secured for study. Two males mounted in clarite have shell measurements as follows: length, 0.45 mm; height behind eye at level of weak sinuation of ventral margin, 0.19 mm; and maximum height at the level of the apex of the dorsal margin, 0.24 mm.

The appendages of the male resemble those of the female. The podomeres of the antennules are not so wide, however, making them appear slightly slenderer in general aspect. The number and position of the setae are identical in the antennules of the two sexes. The antennae of the male (Fig. 2, *F*) present the characteristics associated with that sex. As is common among males of species of *Entocythere*, the penultimate podomere of the present species is so divided that each antenna appears to be composed of five podomeres. Two setae stand at the flexor-distal corner of the basal portion of the penultimate podomere, while a third seta is located on the ventral margin slightly anterior to the center of the distal portion. The antenna of the male terminates in three claws. The ventral claw is long and has very poorly developed teeth along only the terminal one-third of the concave surface. These teeth are much weaker than usual in males of species of this genus. The extreme tip of the ventral claw is bent ventrad. The dorsal or anterior claw is shorter and heavier than the first claw described and bears long teeth arranged comblike along the distally flattened margin. The third claw is mesial in position, being interposed in position between the bases of the other two claws. This third claw has a length equal to about two-fifths of the length of the ventral claw and just reaches the proximal limit of the flattened area of the dorsal claw. The teeth of the mesial claw are much better developed than the teeth of the ventral claw. Perhaps as a sexual difference, the seta of the basal podomere of the endopodite of the antenna reaches to the center of the ultimate podomere of the endopodite, being much longer than the corresponding seta in the female. With respect to the mouth parts, the limited material available makes impossible accurate checking of all details pertaining to the mandible of the male. There seems, however, to be close agreement in structure of the mandible in the two sexes. It was clearly seen that the

distal end of the ultimate podomere of the mandibular palp of the male bears a long, heavy, gently curved spine close to the base of which originate two slender, short setae. The maxilla of the male allotype appears to have a respiratory plate bearing 17 rays or setae. The setae of the respiratory plate could not be counted accurately on the male paratype available. The slight variation of the allotype from the 16-rayed condition observed in the female holotype is no more than can be expected as an individual difference. No essential differences were noticed between the thoracic legs of the female and the male.

The copulatory organ (Fig. 2, *G*) differs distinctly from that of other known *Entocythere* species. The base of this structure terminates in a well-chitinized, truncate lobe. The base supports three accessory pieces, of which the dorsal is fleshy in appearance and consists of a short base and a long, slender terminal spine. The second or middle accessory piece has a much longer base directed distally and anteriorly, extending just beyond the end of the base of the copulatory organ. The second accessory piece is terminated by a slender, curved spine approximate in length to the spine of the first accessory piece. The third accessory piece or "clasping appendage" (Fig. 2, *H*) is sickle-shaped or falciform, curved more distally than proximally, and formed of a highly chitinized bar, distally widened and fan-shaped, marked terminally by longitudinal corrugations or grooves. This "clasping appendage" reaches almost to a level with the end of the spine of the second accessory piece.

Remarks.—*Entocythere humesi* may be separated from other species of the genus *Entocythere* by no single characteristic except the shape of the "clasping appendage" of the male copulatory organ. A combination of characteristics will serve, however, in the case of the female, for separation of *E. humesi* from other described species. This is the only species that has a combination in the female of four terminal setae on the antennule, an undivided penultimate podomere in the antenna, and two respiratory setae representing the respiratory plate of the mandible.

Distribution.—Known only from the type locality.

Entocythere copiosa Hoff, 1942

In 1942, the present writer reported *E. copiosa* as abundant from a number of different species of crayfishes collected from several localities in Illinois. The present study reveals the occurrence of this species in many collec-

TABLE 1.—COLLECTIONS OF THE EPIZOIC OSTRACOD ENTOCYTHERE COPIOSA

Date	Crayfish host	Habitat	Location
14-VI-1942	*Procambarus clarkii* (Girard) *P. blandingii acutus* (Girard)	Roadside ditch	Near Port Allen, West Baton Rouge Parish, La.
14-VI-1942	*P. clarkii* (Girard)	Roadside ditch	Near White Castle, Iberville Parish, La.
15-VI-1942	*P. blandingii acutus* (Girard)	Roadside ditch	Near Alexandria, Rapides Parish, La.
15-VI-1942	*P. hinei* (Ortmann) *P. clarkii* (Girard)	Roadside ditch	Near Livonia, Pointe Coupee Parish, La.
15-VI-1942	*P. blandingii acutus* (Girard) *P. clarkii* (Girard)	Roadside ditch	Near Westover, West Baton Rouge Parish, La.
16-VI-1942	*P. blandingii acutus* (Girard) *Orconectes clypeata* (Hay)	Roadside ditch	Near Dry Prong, Grant Parish, La.
17-VI 1942	*Orconectes meeki* (Faxon)[1] *P. blandingii acutus* (Girard)	Stream	Ivesville, Pulaski County, Ark.
25-VI-1942	*P. clarkii* (Girard)	Bayou	Walnut Log, Obion County, Tenn.
26-VI-1942	*P. clarkii* (Girard)	Bayou	Walnut Log, Obion County, Tenn.
13-VII-1942	*P. clarkii* (Girard)	Bayou	Walnut Log, Obion County, Tenn.
20-VII-1942	*P. clarkii* (Girard)	Lake	Lake Center, Obion County, Tenn.
25-VII-1942	*Cambarus d. diogenes* (Girard) *Orconectes i. immunis* (Hagen)	Stream	South of Walnut Log, Obion County, Tenn.
25-VII-1942	*O. i. immunis* (Hagen)	Small stream	South of Walnut Log, Obion County, Tenn.
25-VII-1942	*O. i. immunis* (Hagen)	Pool in stream bed	Near east side of Reelfoot Lake, Obion County, Tenn.
25-VII-1942	*Procambarus clarkii* (Girard)	Small stream	Near east side of Reelfoot Lake, Obion County, Tenn.

[1] Males of *O. meeki* in this collection reported as slightly atypical.

tions from widely separated areas in Louisiana, Arkansas, and Tennessee. Data relative to these collections are given here in tabular form.

The data in the table show an apparent lack of habitat selection in the instance of this species, since the form is found in roadside ditches, pools, lakes, and various types of streams. This lack of habitat preference is in direct contrast to the condition mentioned with reference to *E. riojai*.

Entocythere illinoisensis Hoff, 1942

Besides the Illinois localities for *E. illinoisensis* given in the writer's paper of 1942, this rather infrequent species is now known from two localities in Arkansas. Near Casa, Perry County, Ark., a collection of 11 individuals of *Orconectes longimanus* (Faxon) produced several ostracods of the species *E. illinoisensis* in association with several specimens of *E. riojai*. The collection was made from a swiftly flowing stream on June 17, 1942. A second collection of *E. illinoisensis* was made on the same date from a small stream near Ivesville, Pulaski County, Ark. Two individuals, one male and one female, of this species were obtained from a collection of the crayfishes *Orconectes meeki* (Faxon) (males slightly atypical) and *Cambarus blandingii acutus* (Girard). Also in this collection were large numbers of *Entocythere copiosa*.

Like *E. riojai*, the present species favors stream habitats and in most cases has been collected from streams where there is considerable current. This is shown not only by the present records but also by the several previous records (Hoff, 1942).

In the collection from near Ivesville, Ark., the female agrees in detail with type specimens, but the male is somewhat atypical, since the pronounced knob or projection on the convex side of the "clasping appendage" of the male copulatory organ is greatly reduced. The "clasping appendage" is otherwise not abnormal, resembling in detail typical individuals of *E. illinoisensis*. The modified "clasping appendage" of this atypical male to some small degree resembles that of *E. cambaria* Marshall 1903, but other body structures are certainly not those of *E. cambaria*. For the present, until more material can be procured, this specimen will be assigned to *E. illinoisensis*. Upon the acquisition of additional material, it will be possible to show either that this one individual is abnormal or that a new species or subspecies is represented.

SUMMARY

1. Two species of the genus *Entocythere*, *E. riojai* from Illinois and Arkansas and *E. humesi* from New York, are described as new.

2. Locality records extending the geographical ranges of *E. copiosa* and *E. illinoisensis* are given.

3. *E. riojai* and *E. illinoisensis* have been found to occur only on crayfishes from small streams where there is considerable current. *E. copiosa* apparently does not show any habitat preference.

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Obituaries

WILLIAM ALBERT HOFFMAN, head of the department of parasitology in the School of Tropical Medicine, San Juan, Puerto Rico, died on April 4, 1943. Born in Jersey City, N. J., April 18, 1894, he obtained his B.S. degree at Cornell University (1917) and his Sc.D. at Johns Hopkins University in 1924. After teaching entomology and zoology at Iowa State College from 1917 to 1918, he was associated with the U. S. Department of Agriculture until 1920, and then served a year as assistant entomologist to the State of New York. While at Johns Hopkins (1921–24) he was assistant in medical entomology and, upon graduation, was sent by the Rockefeller Foundation to Haiti as medical entomologist in a survey of that republic. In 1926 he joined the newly founded School of Tropical Medicine and was delegated to organize its department of parasitology, with which he was closely identified until his death.

While in Haiti, Professor Hoffman was particularly interested in the anophelines of the region. In Puerto Rico he clarified and defined the epidemiology, distribution, and biology of schistosomiasis as found there. Some of his investigations on the biology of schistosomes were carried out in close collaboration with Dr. Ernest C. Faust. Among the important findings relating to this parasite were the experimental proof of the snail species that serves locally as the intermediate host, improvement of concentration methods in searching for ova in the feces, refinement of experimental means of inoculation of animals with cercariae, and, in collaboration with Dr. W. H. Taliaferro, development of a highly promising skin test. He also contributed to our knowledge of filariasis and *Fasciola hepatica* and to the biology of several parasites of domestic animals.

Hoffman's main interest, however, was in the field of taxonomic entomology. As an outstanding authority on the Ceratopogonidae he was widely consulted on problems of identification; he described several new species of *Culicoides* and, with the late Dr. Francis M. Root, published a review of the North American species of that genus. His listed publications number about 60, including important sections in Wolcott's *Entomologie d'Haïti* and Gay's *Aspects of disease and host resistance*. He belonged to several scientific societies.

Professor Hoffman will be remembered by a wide circle of admirers and friends not only for his scientific accomplishments but also for his rare ability to inspire enthusiasm in all who worked near him; for his unstinted generosity toward those who needed a helping hand; for his devotion to the art of music; and for the humble simplicity and almost ascetic austerity of his life.

RICHARD FAY JACKSON, senior chemist, National Bureau of Standards, died at his home in Chevy Chase, Md., on June 1, 1943. He was born in Dorchester, Mass. on January 2, 1881. He attended the Boston Latin School and Harvard University, receiving the degree of A.B. (magna cum laude) from the latter in 1903 and the Ph.D. degree in 1917 from the same institution. Upon the completion of his undergraduate work at Harvard, Dr. Jackson served as research assistant at Massachusetts Institute of Technology from 1905 to 1907. He entered the Government service on October 1, 1907, as laboratory assistant in the Polarimetry Section, National Bureau of Standards.

An enthusiastic and painstaking worker in the field of sugar chemistry, Dr. Jackson directed his researches into the investigations of problems dealing with the physical properties of the sugars and to the development of new and improved methods of their preparation, purification, and estimation. He made extensive studies of the sugars, sucrose, dextrose, and levulose, and his many articles on their physical and chemical properties received international recognition. In recognition of his contributions on levulose, the Washington Section of the American Chemical Society awarded him the Hillebrand prize in 1925, Dr. Jackson being the first recipient of this honor. His phase-rule studies of the system lead acetate, lead oxide, and water and the system dextrose, levulose, and water have been accepted as authoritative. His studies on the preparation and hydrolysis of inulin led to his discovery of three new crystalline difructose anhydrides among the products of hydrolysis.

Dr. Jackson was an untiring worker in the affairs of the Association of Official Agricultural Chemists, serving for many years as associate referee on reducing-sugar methods and for the past several years as general referee on sugar

and sugar products. He was a member of the International Commission for Uniform Methods of Sugar Analysis and contributed generously of its efforts.

Dr. Jackson was a member of the American Chemical Society, the Washington Academy of Sciences, the American Institute of Chemists (fellow), and the Chemists Club of New York.

CARL F. SNYDER

WILLIAM ALBERT SETCHELL, algologist, plant geographer, and chairman of the Department of Botany of the University of California for nearly 40 years, died in Berkeley, Calif., on April 5, 1943. He was born in Norwich, Conn., on April 15, 1864. As an undergraduate at Yale University, his boyhood interest in biology and especially cryptogamic botany was stimulated primarily by D. C. Eaton. After matriculation young Setchell was enabled to continue his work in botany, under W. G. Farlow, at Harvard, where he was awarded the doctorate in 1890. He returned to Yale as an assistant but was soon attracted to Berkeley.

The series of papers on the marine algae of the Pacific coast of North America by Setchell and N. L. Gardner contain probably his best known writings. Although a fully competent taxonomist, he never regarded classification as a final goal but was always more deeply interested in the "dynamic aspects" of biology—a point of view that he vigorously encouraged in his students. From this study of the algae of North America, he was led to investigate the marine flora of other Pacific areas. An association with the Carnegie Institution of Washington permitted Professor and Mrs. Setchell to make a series of trips to the Pacific islands, Australia, New Zealand, eastern Asia, and South Africa. These travels were designed primarily to facilitate investigation of the nature of reef-formation but they also aroused or augmented his interest in ethnobotany, insular endemism, trans-oceanic migration, and the classical problems of plant distribution from a possible "antarctic" center.

Geobotany—which he defined as a synthesis of the distributional, ecological, and genetic or historical phases of the study of taxonomic entities and associational groupings— attracted nearly as much of his attention as did taxonomic study of cryptogamic plants. He liked to emphasize the importance of occasional chance dissemination of germules by normal agencies and was loathe to accept the promiscuous shifting of poles and continents or the rise and fall of land bridges to explain distributional patterns.

From a study of temperature effects on the development of algae and marine flowering plants, he became interested in the temperature thresholds in the life cycle of flowering land plants. He devoted particular attention to certain of the hypogeous fungi and to the morphology of the Balanophoraceae. He was the instigator of the important genetic investigations on *Nicotiana* extended by R. E. Clausen and T. H. Goodspeed and their students. His published scientific contributions, dating from 1883 to 1943, embrace about 150 titles.

Professor Setchell was a member of the National Academy of Sciences, the Washington Academy of Sciences, and of the American Philosophical Society; a fellow of the American Academy of Arts and Sciences, the American Geographical Society, the Torrey Botanical Club, and the California Academy of Sciences; a sustaining member of the California Botanical Society; and a member of the Linnaean Society of London, as well as of many other scientific organizations, both in this country and abroad.

His students remember him as a stimulating if unorthodox teacher. His wealth of experience and observation and the diversity of his interests, combined with a keen critical judgment, enabled him to digress interestingly in any direction. He took a particularly warm interest in the education and personal life of many young students, the informal and populous "Order of Nieces and Nephews," whose members are to be found all over the world. Despite the number and excellence of his written contributions to science, it may well be that his influence on their careers and lives will outweigh all his other accomplishments.

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